



# EPIC2019 AGENCY

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## Film

Session Curator: Charley Scull

Considering the theme of agency through the lens of film offers many avenues for exploration, in terms of both the stories that film can feature and the power of the film itself to be that agent of change. This session features four films, screened in two pairs with a brief Q&A following each set. The first set of films provokes us, as viewers, to consider who is the client and who or what has the agency in the system. One film addresses food security and resilience from the perspective of citizen youth journalists and the other tells the story of high-stress pre-school programs through the eyes of educators in those programs. The second pairing explores the tension between constraints and possibilities through two distinct subjects and storytelling styles. The first is an ethnomethodological experiment involving families living in smart homes and the second is a meditative portrait of a young man who challenges assumptions about who he can or should be.

## Food for Thought

### The Path to Food Security in Newark, NJ

RUCHIKA MUCHHALA, *Third Kulture Media*

*Mostly filmed by youth, Food for Thought is a documentary film that dissects the state of food security and access to healthy foods in Newark, New Jersey, one of the U.S.'s largest "food deserts". Newark was voted the most stressed city in America 2017 based in part on high rates of obesity and diabetes, both diseases associated with the systemic issue of food insecurity. In response, RWJBarnabas Health and the Greater Newark Community Advisory Board, spearheaded the "Food for Thought" research initiative, that draws on community-based assets and solutions to address food insecurity. The film features interviews with community activists, urban farmers, public health experts, city officials, and local youth ambassadors, all from within the community. Using participatory design research methodologies, twenty-five youth were trained to use their camera phones as citizen journalists. The youth and community board members were then a part of the process of synthesizing the data (in the editing process), and lastly, after the film was completed, community members facilitated discussions within the community to further the research outcomes.*



"Food for Thought"—Ruchika Muchhala

**Ruchika Muchhala** is a filmmaker and design researcher based in New York City. Ruchika has directed and produced two feature documentaries, "The Great Indian Marriage Bazaar" and "Beyond Bollywood". Both these films have been shown at international film festivals and broadcast on television, and can currently be watched on Netflix. Ruchika has produced television shows and documentaries for VICE Media, MTV, History Channel, Discovery Channel, Crime & Investigation Channel, and RedBull TV, as well as numerous independent films and campaign videos for nonprofit and grassroots clients. She holds a BA in Film Studies and Sociology from The University of Michigan and an MFA in Design for Social Innovation from The School of Visual Arts. She currently works at The Sound, where she works on recruiting, research planning and shoots film.

## The Learning Library

### Using Ethnographic Film as an Organizational Change Tool by Scaling Human Insights across a National Preschool System

HAL PHILLIPS, *Bad Babysitter*

MEG KINNEY, *Bad Babysitter*

*Attracting and retaining teaching talent was a significant problem for Primrose Schools – a premium priced leader in early education with 375+ franchised schools. Despite all of the enthusiasm and growth around early education, teacher wages have remained stagnant at a national average of \$10.60/hr. Healthcare is rarely covered, hours are long, and the job is demanding. Unsurprisingly, there is a 30% turnover rate for preschool teachers industry-wide. This challenge became the basis of a generative study designed to understand the lives of preschool teachers in and outside of the classroom. In-depth interviews were filmed and edited into “insight sequences” that revealed deep misperceptions between school owners and teachers. The findings found their way beyond corporate. They were turned into a system-wide “Learning Library” seen by over 11,500 employees, compelling a Franchisee-led task force to address pay and benefits.*



“Learning Library”— © Bad Babysitter

**Meg Kinney** and **Hal Phillips** are partners of Bad Babysitter, a boutique consultancy specializing in video ethnography. Their practice was founded in 2008 on the belief that when business leaders fail to contextualize hard data, the human experience gets trivialized. They blend ethnographic thinking, documentary storytelling, and business acumen to viscerally give life and meaning to data through human insight. Meg’s background in consumer behavior as an executive leader in brand strategy combined with Hal’s background

in philosophy and video production gives their clients actionable understanding of the people they serve. Bad Babysitter works with Fortune 500, startups, and non-profits alike to help them grow in relevant and meaningful ways.

[hal@thebadbabysitters.com](mailto:hal@thebadbabysitters.com) & [meg@thebadbabysitters.com](mailto:meg@thebadbabysitters.com)

## Clyde in Mulberry

ALLEGRA OXBOROUGH, *Aero Creative*

*Clyde in Mulberry is an observational film about a young man who has decided to move from his native Bronx neighborhood to rural Florida. A departure from the typical corporate ethnographic film, Clyde avoids talking heads, strategic soundbites, and bulleted takeaways. Instead, the film recreates the intimacy and breathlessness of being in-field, and asks audiences to gather information with attention and stillness. This portrait of agency in the life of a Black American GenZ-er questions held beliefs and stereotypes by presenting a picture of one person's experience.*



“Clyde in Mulberry”— © Allegra Oxborough

**Allegra Oxborough** is a film director and the owner of AERO Creative, a production company specializing in consumer insights and market research. Combining expertise in strategy and qualitative research with documentary production and storytelling, AERO has been a video partner for clients including LRW, McCann, Schireson, Target, The North Face, Facebook, and Google. In her personal films, Allegra explores vulnerability in human relationships. She creates narrative works rooted in a documentary process, and her recent short “Distance” was praised for its “intoxicating ability to capture private conversations with dead-on accuracy.” Watch [Distance on Nobudge.com](https://www.nobudget.com/watch/distance).



## Agency in the Smart Home of the Future

NICK AGAFONOFF, *Real Ethnography*

*Agency in the Smart Home of the Future is a short documentary film about a unique design fiction social experiment. Comprised mostly of trace evidence video footage recorded by field researchers on their smart phones, the film takes audiences directly into the reflexive lived experience of four Australian households, each of whom have had their real homes transformed into fully functional smart homes. Smart speakers, smart TVs, smart fridges, robo vacs, sensor lighting, etcetera! is installed into their homes as a gestalt to generate a paradigmatic shift in their everyday living and interactions. In the process, we discover how human agency and structure reproduce in this potential living environment of the future.*



“Agency in the Smart Home of the Future”— © Nick Agafonoff

**Nick Agafonoff** is a self-described video ethnomethodologist who specialises in employing breaching techniques in combination with videography as inquiry, to scientifically explore the production of social realities and social facts by social group members. He consults predominantly within the areas of marketing, design, brand, innovation and consumer research. His past clients include the likes of FaceBook, Google/YouTube, McDonald’s, VolksWagen, Mars and Nestle, to name just a few. Currently, Nick works as the Director of Lived Experience at The Practice Insights and also directs Real Ethnography Pty Ltd. From a filmmaking making perspective he has directed and produced hundreds of video ethnography programs for commercial research clients over more than 20+ years. In 2005 he produced, directed and edited ‘Bougainville Sky’, a feature length documentary film about an unarmed peace process in Papua New Guinea.

[nick@realethnography.com.au](mailto:nick@realethnography.com.au)

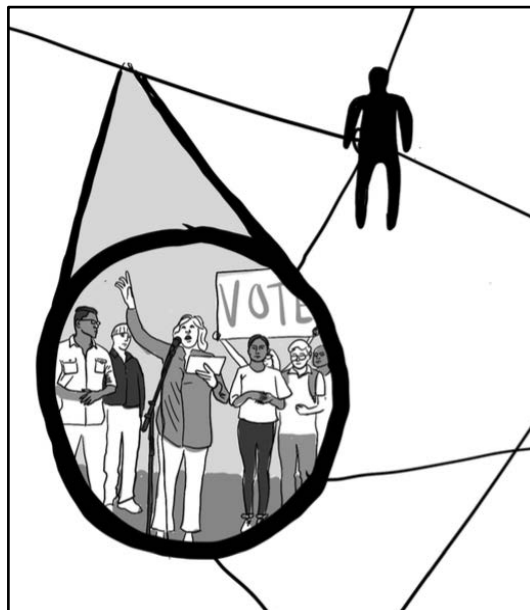
## The Ethno-Graphic Sensibility

JAMIE McPIKE, *Instagram*

DIANA GRAIZBORD, *University of Georgia*

ANNA LeBER, *Independent Artist*

*Ethnography is both a set of tools and a way of approaching the world, but ethnographic methods texts tend to reduce ethnography to its tools, minimizing the humanistic elements of our work and ignoring how these tools interact with the social world. Recent work on “ethnographic thinking” helps us shift from an instrumental focus on tools, but we believe that if “the medium we think in defines what we can see”, then textual, linear narratives limit our ability to see and learn about the sensory, embodied, aesthetic, and emotive dimensions of ethnography. We, therefore, ask: how might we reimagine how we teach and learn about ethnography and the ethnographic sensibility? How can we teach beyond the tools? Comics as a medium affords multiple possibilities for expressing the complex dimensions of ethnography. Comics, like ethnography, allows for the simultaneous representation of multiple ideas, perspectives, and experiences. It requires the reader to participate and grapple with the setting, the emotions of the process, the visual feel and mood of a place, and enables a “you are there” sense of place due to the juxtaposition of visual and textual forms. We believe comics can help aspiring ethnographers explore the dynamism inherent in this work.*



"The Space Between" by Anna LeBer

**Jamie McPike** is a User Experience Researcher at Instagram with a PhD in Sociology. For nearly a decade, she has used ethnography to bring tangible changes to policies, programs, and products in diverse sectors. [mcpikejamie@instagram.com](mailto:mcpikejamie@instagram.com)



## Gallery Installation

**Diana Graizbord** is Assistant Professor of Sociology and Latin American and Caribbean Studies at the University of Georgia. Her research examines expertise in politics and how ethnography and sociological storytelling can inform policy. [\*\*dgraizbord@uga.edu\*\*](mailto:dgraizbord@uga.edu)

**Anna LeBer** is an illustrator and designer with a BFA from the University of Georgia. She works in diverse design media, from fine art and illustration to web and print design. [\*\*anna.e.leber@gmail.com\*\*](mailto:anna.e.leber@gmail.com)

## Socially Informed Policy and Planning for Autonomous Mobility

KATE FISHER, 3x3

*Autonomous vehicles as a mode of public transportation offer the potential to grow public and private sector partnerships, improve mobility, strengthen the economy, reduce negative environmental impacts, and benefit the health and well-being of citizens. But these advantages will only materialize if technology is designed with the right foresight, aligned around public awareness and sentiment, and is planned with communities.*

*Starting in Spring 2019, the first national public AV shuttle pilot was implemented in Providence through the Rhode Island Department of Transit along the Woonasquatucket Corridor to fill a critical transportation gap in the city. The gallery presents insights from the multidisciplinary research, including ethnographic methods, featuring the participatory design tools used throughout Providence. The research objectives are to A) inform Rhode Island's planning and regulation related to transportation innovations, B) help improve the shuttle's user experience and service delivery, and C) contribute to a broader policy and scholarly discussion of how residents, businesses, and regulators interaction with new transportation technologies.*

*3x3 helps civic organizations collaborate with their stakeholders, apply insights from applied research to design initiatives, and produce outputs that unlock social value.*



© 3x3

**Kate Fisher** is a Program Manager and Strategist at 3×3 Design. She brings her background in user experience design, research, policy analysis, and participatory planning to public sector and social impact projects.

## Exploration of the Value of Facially Expressive Avatars with VR Developers

AYFER GOKALP, *Facebook AR/VR*

JACQUELINE POSPISIL, *Facebook AR/VR*

*Ayfer Gokalp and Jacqueline Pospisil are Facebook user experience researchers from Seattle, Washington, United States, and they focus on the development of software and hardware products within the virtual reality (VR) space. For this research, they explored the value of a facially expressive avatars for avatars in VR. Facially expressive avatars is a research prototype that allows users to reflect their real facial gestures on their virtual avatars in real-time. For example, if you smile, your virtual avatar smiles as well. They conducted focus groups with VR developers about the potential value of facial expressiveness and found that expressing both positive emotions (e.g., happiness, excitement, and humor) and negative emotions (e.g., confusion, fear, disgust) are valuable for VR avatars. For instance, expressing fear or disgust facially while playing a zombie game would be more authentic and more immersive. In this gallery presentation you will have the opportunity to try an Oculus VR headset and demo an immersive experience. You will continue by creating your own avatar and edit how it looks. This demonstration will serve as an example of the current state of social VR experiences, and highlight how face-mimicking can improve the users' virtual reality experiences by allowing them to express a wide variety of emotions and build agency within social VR experiences.*

**Ayfer Gokalp** is a User Experiences Researcher at Facebook. Ayfer's research focuses on the meaningful social interactions, inclusion, and integrity in virtual reality spaces. She holds a PhD in Linguistic Anthropology from Arizona State University. Her research at Facebook has contributed to the social VR platform, Horizon, that is recently announced. Ayfer has been informing the AR/VR industry and academics about the importance of inclusion in user research by giving talks at conferences. Prior to Facebook, Ayfer worked as a Design Researcher at HTC, where she conducted research on augmented reality technology. You can reach out to her at [linkedin.com/in/ayfergokalp](https://www.linkedin.com/in/ayfergokalp).

**Jacqueline Pospisil** is a hardware researcher at Facebook, where she focuses her research on the comfort and usability of virtual reality hardware products as well as emerging virtual reality use cases. She holds an M.S in Psychology and a certificate in Human-Centered Design and Engineering from the University of Washington. Her work at Facebook has contributed to the Oculus Rift S and Oculus Quest hardware design, as well as the Oculus Quest First Steps onboarding experience. Prior to Facebook, Jacqueline served as a user researcher at HTC, where she conducted research for the development of Vive-branded virtual reality applications such as ViveportVR and Vive Video. Please reach out to her at [jacqueline.pospisil@oculus.com](mailto:jacqueline.pospisil@oculus.com) with any questions about her work.

## Office Humour

### Diegetic Explorations of Negotiated Algorithmic and Human Agency

JAMES O'NEILL, *Fjord Dublin*  
FRAUKE HEIN, *Fjord Dublin*

*Office Humour is a speculative design piece that explores the culture that might emerge when data points like laughter function as a performance metric. The piece raises questions about agency at multiple levels. Humans can adapt their culture to algorithmic motoring. But is that ok? Do we allow humans and machines the agency to develop their culture together, or should one always be subject to the other? Who has agency in this situation? The humans who create the laughter, or the algorithm who instigates it?*

*The piece functions on the basis of a neural network to take live measurements of laughter from its environment and places them within the narrative of a satirical productivity product. Participants are invited to interact with the product. As they do, they experience how laughter—a very natural and personal sound—can be turned into a data point and used to police and monitor their performance in an inhuman way.*

*The piece tells a story that encourages participants to reflect on the sorts of data they gather in their work and the purposes to which any data may be put in the future.*

**James O'Neill** is a Service & Systems Design Lead at Fjord Dublin which is part of The Dock, Accenture's flagship R&D center. His research focuses mainly on the human experience of AI enabled systems. [james.o.neill@fjordnet.com](mailto:james.o.neill@fjordnet.com)

**Frauke Hein** is a Data Designer at Fjord Dublin at The Dock, Accenture's flagship R&D center. Her work transforms AI technologies into visual and interactive experiences. [frauke.hein@fjordnet.com](mailto:frauke.hein@fjordnet.com)

## What Are Memories Made of?

### A Migrant Community's Experience of Agency in 18<sup>th</sup> Century Hyderabad, India

HEMA MALINI WAGHRAY, *marginaliaa.com*

*This gallery exhibit is a slice of micro history of the Brahma Kshatriya Community of Hyderabad- a migrant Hindu community that moved into a Muslim dominated city in mid-1700s, with Urdu as the state language until 1948. At one level, agency is constituted by creating this archive with data gathered through ethnographic in-depth interviews, collecting photographs, videos, maps, artifacts and diaries. Agency at another level is where this diverse community constituted itself as a group with shared set of rules and institutions related to cooperation, interdependence, a way of life that was culturally syncretic, supporting education, providing financial support to members, setting up social and religious reforms to enable a progressive outlook and lay a foundation for stable growth.*



A brass plate or *paraath*, utilized in a large family or community gathering was borrowed by people in the neighborhood. It is 18 inches in diameter and is about five pounds in weight. This particular plate belonged to my husband's family and it was a token return gift at a wedding, and all the members of this particular wedding party, in 1911, received it. The inscription written is the name of the person who got married- a symbol of syncretism. It reads "Eknath Pershad, grandson of Nand Lal" and it is written in Urdu which was the medium of instruction and common parlance through the 1900s in Hyderabad, India. Image credit: Hema Malini Waghray

**Hema Malini Waghray** is a UX researcher from New Jersey and a sociologist by training. Her client is Krishnakriti Foundation, Hyderabad, India and she is the primary investigator for a project to create a micro history of her community in her hometown of Hyderabad, India.

## Debris

### Intermingling Ethnography with Design and Artistic Practice

DARIA LOI, *Mozilla Corporation*

HEATHER McGEACHY, *Mozilla Corporation*

*This Gallery proposal focuses on the debris left behind by human's daily interactions with non-human agents, with the end goal of providing arts-infused lenses to investigate and help untangle our complex relationships with smart systems. Debris is the outcome of a process that intermingles ethnographic tactics with design probing techniques and artistic practice. The Debris – a series of art pieces resulting from this process – are offered to the EPIC 2019 community alongside artefacts that were used to inform art pieces: ethnographic data collected during the interviews, probing toolkit used to augment interview data, and the thought process of the two involved ethnographers/designers/artists, in the form of notes and sketches.*

*This collection of art pieces, objects, visual commentaries, humans-about-machines accounts represent the fragments that are left behind by human interactions with smart agents - we offer them to prompt reflections, re-connections, and re-discoveries of human-non-human hybrid landscapes.*



“Debris” © Loi & McGeachy

**Daria Loi** (PhD; BArch) is a creative leader with expertise in mixing design strategy with user experience innovation to enrich people's everyday lives and humanize technology. At Mozilla, she leads Product Design for Emerging Technologies. Previously, Daria was Principal Engineer at Intel and Sr Research Fellow at RMIT. <http://www.darialoi.com>

**Heather McGeachy** (MFA) is a creative maker and qualitative researcher with expertise in using deep listening within contextual surroundings to interpret complex relationships humans have with tools and work. Previously, Heather was Head of Design Instruction at Green River CC, and professional artist and gallery owner of Gallery114 in Portland. <http://www.dreamoften.info>.



## Interactive Storytelling

### Bringing Personas to Life through an AR/VR Experience

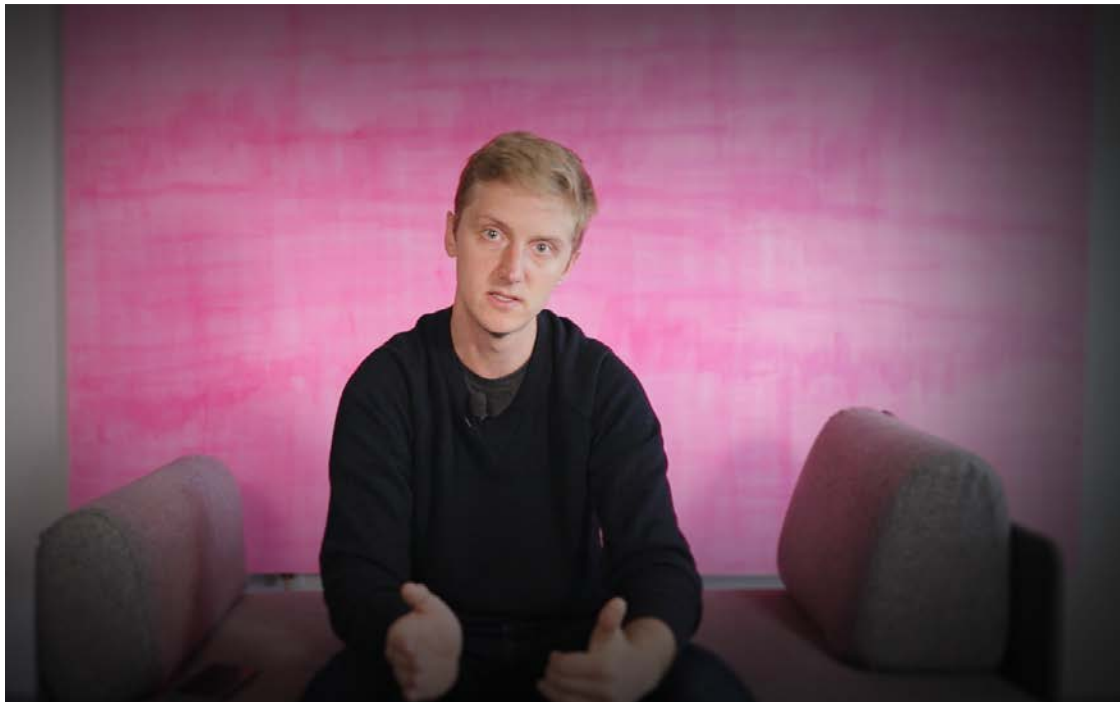
AMY LASATER-WILLE, *Oliver Wyman Studio*

ALAN FINCH, *Oliver Wyman Studio*

*Personas are an effective way to bring customers to life, enabling business owners and designers to have a better understanding of their audiences' needs, values and behaviors in detail. Personas help with building and improving product and brand experiences.*

*There is a diverse set of tools and methods to create personas, and while most are successful in creating detailed stories, they're mostly limited in terms of creating an immersive experience or building a deeper level of empathy.*

*Our AR/VR Persona Experience is a unique, dynamic persona engagement tool that uses best-in class interactive storytelling methods and enables audiences to better visualize and connect with their personas' emotions, habits and aspirations. Based on in-depth, on-site interviews, the AR/VR experience creates an ethnographic experience for the audience in the sense that they are able to deeply acquaint themselves with people and the worlds in which they live, ultimately creating greater understanding and empathy.*



© Barbara Ng

**Amy Lasater-Wille** is the Human Insights Lead at Oliver Wyman Studio. With over a decade of experience in academic and applied consumer research, Amy specializes in bringing a deep understanding of everyday consumer and end-user needs to bear on strategic

## Gallery Installation

problems. She holds a B.A. from the University of Chicago and a Ph.D. in anthropology from New York University.

**Alan Finch** is the Visual Design Lead at Oliver Wyman Studio where he delivers innovative digital solutions for clients across various industries. Before working at Oliver Wyman, he was the Associate Creative Director at POSSIBLE where he brought his love of learning, motion design and digital to deliver innovative, multi-channel experiences for industry leading brands such as Con Edison and Chase Rewards Center. His work has been recognized at the Webby Awards, CSS Awards and MOMA PS1. Alan graduated from the Rhode Island School of Design where he received his BFA in Graphic Design.



## Density Done Right

### Co-Designing Walkable, Sustainable, and Equitable Communities through Digital and Analog Mediums of Public Engagement

BECKY BUCK, *Forge Studio*

KARLA SIERRALTA, AIA, *University of Hawai‘i at Mānoa School of Architecture*

BRIAN STRAWN, AIA, *University of Hawai‘i Community Design Center*

ALISA WEINSTEIN, *Google*

*By 2025, Hawai‘i needs approximately 65,000, affordable housing units. Geographic location, scarcity of land, astronomic construction costs, and speculative investment have led to an unattainable market.*

*Housing is Hawai‘i’s most pressing issue.*

*This exhibit shares the “Hawai‘i Housing Lab” concept developed by the University of Hawai‘i Community Design Center, a public interest design practice led by faculty, researchers, professionals, and students, for the Hawai‘i Public Housing Authority, the state’s primary housing agency.*

*This project was led by two principal investigators with graduate and undergraduate student researchers, in collaboration with an ethnographer and design strategist, the team at KPF Urban Interface, and Alisson Arieff, design and architecture writer at the New York Times, who assisted with framing the conversation for the general public.*

*Thirty in-home interviews were conducted at 17 public housing properties on five islands, Kana‘i, O‘ahu, Moloka‘i, Maui and Hawai‘i. The findings that emerged from the analysis of these contextual interviews, together with secondary research, informed the development of a community engagement process, a design framework, three co-creation tools and a mobile research lab.*



The Hawai‘i Housing Lab pilot launch in Honolulu’s Kaka‘ako neighborhood during Parking Day 2019. Photo credit: Brian Strawn and Karla Sierralta

**Becky Buck** is a UX leader working at the intersection of research, design and new product development. She is co-founder at Forge Studio, a strategic design agency that specializes in taming the complexity of enterprise software.

**Karla Sierralta, AIA** is an Assistant Professor based at the University of Hawai'i at Manoa School of Architecture and co-founder of Strawn+Sierralta, an award-winning, strategy-led architecture, and design studio focused on human-centered spaces, experiences, and services. [karla@strawnsierralta.com](mailto:karla@strawnsierralta.com)

**Brian Strawn, AIA** directs cross-disciplinary teams through projects that cross the fields of service design, design strategy, and architecture. He currently leads public interest design projects for the University of Hawai'i Community Design Center for government agencies, universities, and nonprofits. [brian@strawnsierralta.com](mailto:brian@strawnsierralta.com)

**Alisa Weinstein** is a UX researcher on the Material Design team at Google. Her research is focused on the experience and impact of design system adoption on product development teams and outcomes. She lives in San Francisco.

## Vær

### On Place, Weather, Being, and Agency

ERICA KOWSZ, *University of Massachusetts Amherst*

HUNTER STYLES, *freelance*

*This photo installation is a side-product of ethnographic research in Tromsø, a city of 75,000 tucked along the Norwegian coast above the Arctic Circle. The main research addressed longer timeframes—examining Sami ethnopolitics, institution-building, and social change since the 1970s, a time that marked increased engagement of indigenous peoples with national powers in many countries around the world, including in Norway. That project entailed time on-the-ground in Norway’s far north observing the social diacritics of ethnicity in daily life, public events, and local media. Once we arrived, we found that weather and the changing of the light played a dominant role in our daily experience of life above the Arctic Circle, leading us toward this photo exhibit and contemplation. We had to develop techniques for paying attention to the backdrop—not the microsocial processes of the main research, but rather the steady, shifting hum of the natural world. As a supplement to fieldnotes, shooting quick digital photos and videos became a sensorially-rich means to capture the moment.*

*In this photo installation, we present images of the environment. We use the visual vocabulary of the changing of the light in the arctic to consider the ways in which the natural world’s rhythms act as the original, powerful “automated” force, challenging humans’ sense of agency, creating the context—and certain limits—for their ability to exert their desired outcomes in the world. How can new technologies of automation be built to suit human life where society is already tailored to rhythms of nature that defy assumptions held by many of us living at lower latitudes? Among these 52 tiles, one for each week of the year, we include black tiles representing the time periods that we have never spent in Tromsø, the gaps in our witnessing of the flow of annual natural cycles and annualized events in the collective social calendar of the Norwegian north. These visual and sensorial “gaps” raise questions about the constraints of ethnographers’ knowledge, the reach of technologists’ innovations into the world’s peripheries, and embodied realities of place. Intermittency isn’t inherently a disadvantage in ethnographic work, but it must be accounted for. How do ethnographers admit, adjust for, and overcome the intermittency of their presence at a fieldwork site? This question is especially pressing for those working in industry environments that demand short timeframes for moving from fieldwork to findings. For technologists, there is a related challenge: how to anticipate the ambient and embodied feeling of life where it is lived when they design products that travel across geographies. We hope this photo display provides a fruitful space for EPIC attendees to consider the strengths and limitations of their own methods.*



Evening light at the end of summer in the Lyngen Alps, Troms County, Northern Norway;  
photo by Erica Kowsz, 2019

## Gallery Installation

**Erica Kowsz** is a PhD Candidate in the Department of Anthropology at the University of Massachusetts Amherst. She has long term experience with ethnographic research, dating back to a Fulbright project in Canada in 2011-2012. She has since completed ethnographic research programs in the U.S. and Norway. She can be reached at [ekowsz@umass.edu](mailto:ekowsz@umass.edu).

**Hunter Styles** is a photographer and journalist, currently working freelance, whose photography and writing capture the sensory and affective dimensions of geographic and cultural diversity in locations ranging from Norway to Japan to small town New England. See more of his photography on Instagram: <https://www.instagram.com/hunterstyles/>

## hi how r u?

### Understanding Modern Digital Communication

ERIN RYAN, *Carnegie Mellon University Imaginaries Lab*

*In the absence of physical cues like tone of voice and facial expressions, young people are increasingly using digital communication tools in unexpected or unintended ways to allow for more nuanced online communication. This can involve using punctuation in new ways, spelling words differently, using uppercase and lowercase letters in non-traditional places, and using images, letters, and emojis to create hybrid or intertextual images and emoticons that convey a hyper-specific emotion. This is a new form of digital placemaking that merits its own scrutiny as more and more our digital relationships and interactions hold a weight that rivals our physical ones.*

*Through a series of workshops, this project explores how digital communication has evolved within the constraints of modern-day messaging platforms, and how it can be furthered without them. These research methods could be used not only to understand and better document the ways in which these tools for digital communication are being used across different demographics, but also as a participatory method to understand how users think and feel in a more visual way. Furthermore, the analog method of collaging digital elements used in these workshops could be adapted to be used with a different set of “tools” to test specific digital design elements to better understand how they might be used and misused by their audience.*



“Initial Workshop” © Erin Ryan

**Erin Ryan** is a fourth-year design student at Carnegie Mellon with an interest in the relationship between designed artifacts, cultural trends, and behavior. This project was conceived after years of observing and partaking in online culture and communication. If you're interested in getting in contact, her email is [erineryan15@gmail.com](mailto:erineryan15@gmail.com).

## Where Does Cancer Live Now?

JACOB McAULIFFE, *ReD Associates*

REBEKAH PARK, *ReD Associates*

*This gallery is a photographic representation of six ethnographic encounters from a 2018 study of people living with Stage-IV lung cancer. Our photographs capture their lives beyond the hectic whirl of machines, medications, and medical workers, instead bringing radically ordinary expressions of agency into focus. For our subjects, the paradoxical condition of living with a terminal disease prompts a deep and ongoing reflection on the routines of everyday life. These become symbols of loss and reclamation of agency: while ruptures in routines can reveal the limitations imposed by cancer treatment, for others daily activities come to signify cancer kept in check. These photographs and narratives bear witness to those meaningful mundanities by depicting artifacts of past lives and evidence of new normals. Our aim is to show the role that rich, sensorial photography can play in presenting visual evidence for what matters most to the patient throughout treatment.*

*Our photographs also demonstrate the limits imposed on photography by GDPR-regulated healthcare projects, where we must endeavor to capture the lives of people without showing their faces. We found that the very regulatory constraints that threatened to dehumanize our subjects also allowed us to bring their lives into fuller context. Instead of abandoning photography, we depicted the objects, relationships, and places that were most significant to those we met with. These totemic depictions illustrated their relationship with cancer, as well as their shifting evaluations concerning quality of life throughout their cancer journey.*



*Photo: "The Worst Thing is All the Waiting" Credit Thomas Hughes*

**Rebekah Park** currently works as a manager at ReD Associates, and holds a PhD in anthropology from UCLA.

**Jacob McAuliffe** currently works as a consultant at ReD, and holds an MA in history from Yale University.



## PechaKucha and Papers Session

# Everyday Automation

Curators: Elizabeth Anderson-Kempe (Amazon) &  
Ellie Rennie (Digital Ethnography Research Centre, RMIT University)

The AI systems in this session are designed to solve crime, watch your babysitter, support self-improvement and interact with your research participants. You will meet an indecisive vehicle, a home with some missing family members and the world's worst school cafeteria. Welcome to the new networked agency, where our standard ethnographic methods fall short, and where we ethnographers are the humans left struggling to stay "in the loop".

AI systems are already operating within our homes and cars, yet these come with their own blindspots. Home automation systems struggle with the complexity of interactions inside households, listening selectively to a narrow set of users. Autonomous vehicles still require people to make decisions, leaving us with work we would rather avoid. The presentations in this session explore the problematics of master-slave scenarios and raise the possibility of teamwork, where greater situational awareness and engagement can occur. We ask the hard question of what it means to be co-creators with our non-human counterparts. Is human agency just a modern fallacy, a belief that sets us apart from non-humans and justifies control over the natural world?

These scenarios also present challenges for research. How can we do ethnography when AI systems involve elaborate and intersecting networks of human and non-human agents, some of which are invisible to us? Focusing on the problems of data extraction, falling back on 'social context' and observing individual users is insufficient for the task at hand. We need to instead flex our interpretive skills, observe assemblages and listen for the polyvocal dynamics of this new sociomaterial world. Fear not - if that sounds scary, you can always call on your willing AI research assistant.

## Believe in AI: Will You Pray for a Chatbot?

ANDRE TORALES

*Automation and Artificial Intelligence are defying the status quo making us rethink our jobs, our relations and, philosophically, our lives purpose. This emerging trend will affect every aspect of our lives: economically, cultural and socially speaking. If you think that Ethnographic Research is a safe harbor from all these changes, because it is so human and qualitative, you may be wrong.*

*In this Pecha-Kucha, I want to share a story that I, as a researcher, in face of users' pain points bigger than which button to click on an App, thought about products and services to help people using design thinking. During this side-quest, I've faced a lot of challenges and found the answer in developing a chatbot, characterized as a Virtual God, to help people and give advice for better lives.*

*People would tell their problems to a chatbot? People would rely on the chatbot, powered by artificial intelligence, advice, and readings? People would truly believe in the chatbot to make their wishes come true, just as a thousand-of-years religious god? What are the implications of AI and chatbots for our job as researchers? Let's find out together in this presentation.*



Photo by Me

**Andre Torales** is a Senior User Experience Researcher from Brazil. He has over a decade of experience in the Research field. He started working in Advertising Agencies as Account Planner conducting several research projects nationwide, in special DCS/WPP. At this time, he had received Bronze for Research Innovation at Jay Chiat Strategy Awards in NY, US (2009) then he went to Consultancies and now he is working at a Fintech Latin America.



## Robots and the Fallacy of Agency

STEWART ALLEN, *Fuse Foresight*

*What if I told you, that humans are not very special? That the very qualities that make us human are not pre-given features but are rather properties generated by our participation in the world at large. In this view, humans are not mere expressions of blueprints. Rather, we are shaped and fashioned in the course of our lives by many different environments. This presentation challenges the notion of agency itself through an exploration of a recent project we conducted on service robots and human interaction. I raise questions on the nature of our humanness and the idea of 'humanity' as a special, protected class. If we set aside humans as special and unique, we tend to then dehumanise and downscale everything that is non-human, setting the stage for our current malaise where our environment is objectified as a resource to be used up as quickly as possible. I conclude that a shared and sustainable world is one where the qualities of life are accorded to all things, human and non-human alike.*



‘Getting to know one another’. Stewart Allen

**Stewart Allen** is a founding partner of Fuse Foresight – a people-centric strategy consulting firm based in Barcelona, Spain. Stewart holds a PhD in social anthropology from the University of Edinburgh, and is the author of the book ‘An ethnography of NGO practice in India: Utopias of development’ published by Manchester University Press. Email: [stewart@fuseforesight.com](mailto:stewart@fuseforesight.com)

## Ethnography's Role in Seeing the AI's Blind Spots Living amongst AI: Agency of the Household

LAIYEE HO, *Delve*

*Home automation has made big promises for utilizing intelligent technology to help the lives of everyday people, but the potential of the technology can only be as good as our understanding of the world we are trying to improve. In this PECHAKUCHA, I share insights from my years of conducting ethnography in homes where families have lived alongside AI and automated technology. Our initial tries at intelligent technology in the home were modeled after our own assumptions, but it failed to account for the full variables of the 'household', which had an agency of its own. When technology has the potential to disrupt not only our workflows, but relationships between people in the home, it's the responsibility of technologists and ethnographers to provide the critical human perspective necessary for technology to live in harmony with people.*



Illustration by Kendra Allenby

**LaiYee Ho** is the co-founder of Delve ([www.delvetool.com](http://www.delvetool.com)), where she pours her years of experience as a UX researcher and designer into creating tools for researchers. Before beginning her entrepreneurial journey, she was one of the first UX designers of the Amazon Fire TV. She then went on to build the first UX research team at a smart home automation startup, where she learned how to uncover human motivations. She has a degree in Information Science from Cornell and lives in New York City. [laiyee@delvetool.com](mailto:laiyee@delvetool.com)

## A.I. Among Us

### Agency in a World of Cameras and Recognition Systems

KEN ANDERSON, *Intel Corporation*

MARIA BEZAITIS, *Intel Corporation*

CARL DISALVO, *Georgia Tech*

SUSAN FAULKNER, *Intel Corporation*

*This paper reports on the use and perceptions of deployed A.I. and recognition social-material assemblages in China and the USA. A kaleidoscope of “boutique” instantiations is presented to show how meanings are emerging around A.I. and recognition. A model is presented to highlight that not all recognitions are the same. We conclude by noting A.I. and recognition systems challenge current practices for the EPIC community and the field of anthropology.*

Unknown, Caucasian, male, grey hair, 80 kgs, 1.8m, 55-60 years at entrance 2.

Unknown, Caucasian, male, grey hair, 80 kgs, 1.9 m, 55-60 years in hallway 1.

Unknown, Caucasian, male, grey hair, 78 kgs, 1.9 m, 55-60 years located in café 2.

Unknown, Caucasian, male, grey hair, 80kgs, 1.8 m, 55-60 years located in hallway 3.

Unknown, Caucasian, male, grey hair, 80 kgs, 1.8m, 55-60 years located in café 2.

Thousands of “observations” are logged, one about every second, during a single day on campus, ostensibly forming some sort of narrative of the researcher’s day. What kind of narrative is it? That’s the question. What the researcher understood at this stage was simply that this narrative was made possible by a set of networks of cameras connected together; a range of facial recognition systems dispersed across the school campus. Somewhere, or perhaps at multiple points distributed across the network, judgment and decisions were being made, that scripted the actions of others and thereby gave shape, unbeknownst to him, to the actions he might or might not take.

Strangers on campus are noted by the recognition software as “unknowns.” This means that they are not students, staff, faculty, parents, administration, regular service people or even those identified as “concerns.” By the end of a day visit, one of the authors had been spotted in the #2 café at least 3 times, usually in the company of another “unknown” and accompanied by someone who was known. This made the author a kind of “known unknown”, which was an acceptable identity to the system, warranting no further action than to continue to register his presence. In this way, these school recognition systems demonstrated some small ability to deal with uncertainty. Looking from the camera’s point of view, the author, and another researcher had become “familiar strangers” (Stanley Milgram, 1972). Milgram used the concept to help explain the rise of modern cities. In this paper we are flipping it to help think about a new hybrid digital-social landscape being ushered in by A.I. and facial recognition.

## BACKGROUND

Everyday life is a more mixed world experience than ever: digital/analog, machine/human, bits/atoms. Donna Haraway (1984) called out the limitations of such

binaries decades ago, and today such binaries are even more inadequate as our lives are even more hybrid, comprised of more-than-human multiplicities. Advances in artificial intelligence, cloud computing, wireless networking and data collection have ushered us into a new social-material era, one equally exciting and anxiety provoking. But relationships don't come easy and humans and technologies are surely in a protracted period of courting one another. If the industrial age ushered in one set of expectations and accountabilities, artificial intelligence seems to change the character of this courtship—suddenly our relations are much more promiscuous. In part, these distributed and varied encounters are expressive of a shift from products to networks, and concomitantly, a shift from discrete and singular artifacts of value to value as an outcome of connectedness and multiplicity. The shift is one where digital technologies that were previously limited to particular kinds of discreet, controlled, one-to-one interactions are now engaged in constant interaction with many, sometimes multitudes of humans. However, this adjustment period is the beginning, not the end. Self-driving cars, “personalized” agents on our smartphones and household systems, and autonomous robots are just some of the images conjured when A.I. is mentioned. While these examples seem to suggest A.I. is represented by a sleek, singular futuristic technological artifact, several scholars have highlighted how contemporary instantiations of A.I. rely on a complex, distributed, interdependent network of computers, software, data warehouses and infrastructure (Dourish 2016).

This paper offers a critical and ethnographically-informed exploration into key questions surrounding the constitution of A.I. and recognition systems as they permeate the complex practices and relationships that comprise contemporary everyday life. Our focus is on recognition, A.I. and the real time video analytics of recognition that are deployed and used in everyday contexts today. We will empirically illustrate the ways that human and non-human agents participate in building everyday life worlds and cooperate in this shared meaning-making process. We want to focus on the many agents involved, and shift the focus from singularity of device, product, service, and brand to the heterogeneity of intersecting databases, programs, products, services, people and networks.

We are conceptualizing various collections of A.I. and recognition as polyvocal *assemblages* (Tsing 2015, Deleuze and Guattari 2003, Ong and Collier 2004). The concept of the assemblage is salient because these systems are not in fact singularly engineered. They are diverse, more-than-human assortments that are gathered together, sometimes by design, other times *ad hoc*. Even though we might experience them through discreet interactions, as coherent services, their composition is multifaceted, often entangled. Our hope is to develop a critical appreciation for how diverse materialities, cultures, agencies, and experiences blend together in these emerging assemblages.

This use of assemblages has been employed to shift the framework of research to place greater emphasis on the dynamic, changing, and opaque characteristics of these A.I. recognition assemblages, as well as to bring in non-human participants. The approach enables agency of objects and the possibility of heterogeneity of assemblages. The researchers here are positioned to observe how elements are understood to cohere in existing or developing assemblages. Unlike Tsing's mushrooms (2015) or Bennett's (2009) green chilies, we did not have a material object to focus upon, rather this is the ground work to understanding how thoroughly entwined systems can mutate and develop over time [and space] and frame what is possible, desirable and expected of recognition systems. As Deleuze and Guattari (1987) note in their original writings on assemblage's, they are

“anticipatory” and concerned with continuing trajectories and future possibilities of what these assemblages might become, which seem particularly apt as we research A.I. and recognition technologies. The alternative of conceiving A.I. and recognition uses as discrete products or systems would imply a closed-ended and functionalist understanding that hides the series of interconnected and interdependent sets of technologies, institutions, agendas and people. What emerges here are partial directions and pressing questions related to the topic of the conference - agency: as artificial intelligence becomes an agent, what are the opportunities and challenges for shaping relationships to continue to enable agency? And what kinds of agency are possible in a world where technical things can know and do?

## APPROACH

Since 2017 we have conducted four field research projects in China and two studies in the USA.<sup>1</sup> In 2017 we elected to study these A.I.-recognition technologies because they offered attractive solutions to address many contemporary needs for identification and verification. These technologies brought together the promise of other biometric systems that tie identity to individual, distinctive features of the body, and the more familiar functionality of video surveillance systems. This latter aspect has also made them controversial, which motivated our research to get a deeper understanding. In the USA, there has been growing social and political concern around the use of facial recognition systems. Samplings from the press in recent months include stories in the BBC (White 2019), Wired (Newman 2019), New York Times (Teicher 2019), Washington Post (Harwell 2019), CNN (Metz 2019) and The Guardian (2019), to name a few. In contrast, China’s facial recognition systems, found in urban centers like Shanghai, Beijing and Hangzhou, were becoming ubiquitous even in 2017. In China, these recognition technologies continue to grow in sectors like civic behavior, retail, enterprise, transportation and education. Business Times (2019) reports that Alipay facial recognition payment is already deployed in 100 cities and will pay \$582 million to expand further. Tencent, is adding facial recognition payments to the WeChat platform of 600M users. In a society that has had overt and everyday surveillance in human and institutional form for over 70 years, the emergence and deployment of recognition through cameras has been less controversial than in the USA.

We also chose to study these systems because recognition technologies, for all of their social and political controversy, allowed us to continue to talk about humans. Unlike some other A.I. systems, recognition technologies rely upon human embodiment, action, and often interaction. This is significantly different from, for example, machine learning systems that use social media as proxies for human activity. We hypothesized early that camera systems were harbingers of new interaction models with humans, and that recognition technologies, in particular, were examples of cameras literally reaching out to people, albeit awkwardly and often inaccurately. For even when deployed as a surveillance use case, the experience of being seen at a distance in a public space equipped with CCTV was a kind of interaction that implicated a more complex web of human users with specific interests and motivations. These new interaction models are suggestive of notions of embodied interaction (Dourish 2001) but also, due to the seamlessness of these recognition systems, these new interactions also seem to elude some of the situations of collaborative meaning-making we are accustomed to. As these systems become so commonplace that they disappear, and our interactions with them become just another everyday action (“smile to

pay”), how do we—humans—participate with these dynamic, but elusive assemblages to make the worlds we want to inhabit?

In 2017 facial recognition systems were emerging in the mainstream landscape at a global scale just as companies like Intel were shifting business interests to the cloud and networks, and in the communications arena to 5G. The technologies emerging to transform the network, mobilized further by 5G’s emphasis on machine to machine compute, indirectly signaled that the interaction model of human and device, a hallmark of the PC ecosystem, was no longer the asset to exploit. Today’s technology industry conversations about “edge” and the challenge faced not just by silicon companies, but by cloud service providers, telecommunications companies, telecom equipment manufacturers, original equipment manufacturers, and even content providers on “last mile access” and how to bring compute closer to where data is produced, simply do not focus on what people do with technology. In this business context, increasingly distant from end-users, facial recognition provided us with a way to continue to talk about humans at a moment where so many only wanted to talk about machines.

Finally, we were skeptical not about the fact of facial recognition becoming ubiquitous in China, but about the contrast cultivated by the USA press relative to deployments at home. The research concerns in the USA on facial recognition have centered on three points: 1) recognition systems were biased in their development (Burrell 2016; Crawford and Shultz 2013; Eubanks 2017; Noble 2016; O’Neil 2016; and Pasquale 2016); 2) the systems created new risks to privacy (Dwork and Mulligan 2016; Introna 2009); and 3) there were ethical concerns about use (Horvitz and Mulligan 2015; Stark 2019). While Eubanks (2017) has equated their development to the rise of “eugenics”, Stark (2019) equates the potential dangers of recognition to “plutonium.” But these concerns have not necessarily resulted in fewer systems adopted. Indeed, Gartner (Blackman 2019) projects recognition to be the fastest growing Internet of Things (IOT) space in the near future. Further, we have seen deployments expand in the USA since 2017 in public city infrastructure as well as airports, private school campuses, industrial facilities, summer camps and childcare settings. Further, the US government says facial recognition will be deployed at the top twenty US airports by 2021 for “100 percent of all international passengers,” including American citizens, according to an [executive order](#) issued by President Trump (2017). By examining deployed uses of recognition, we hoped to provide empirical evidence to fill the gap between building, speculation and future deployments.

In what follows we share a kaleidoscope of vignettes from the field to supply the raw material for a discussion about value and its complexities for A.I. and recognition. The use of kaleidoscope is intentional in that it is not the scientific instruments of telescope or microscope that we employ here, but images of instantiations of new technology with people; images left open for further interpretations. As Gibson (1999) notes, “The future is already here – it’s just not evenly distributed.” While there has been plenty of speculation on the cataclysmic possibilities of A.I., there has been a dearth of studies on tangible, instantiations; so, something that is more “what it is” than “what might it be.” We will share snapshots of a future world of A.I. and recognition that is already here. We focus on what could be called “intimate” or “boutique” uses of recognition; so, not massive surveillance systems, but closed institutions or community uses. The snapshots don’t tell a complete story—there isn’t one to tell—nor do they provide a perfect compass for navigating the emerging new spaces unfolding before us. Instead, they are glimpses into the kinds of

questions a compass can address, and the kinds of terrain it should help us navigate. From these vignettes, we raise questions about future research and practice for the EPIC community.

## STORIES FROM THE FIELD

### Everyday & Uneventful Facial Recognition

Popular visions of A.I. are seductive, but real-world facial recognition is amazingly boring in China. A few of the A.I. systems we experienced delivered identification for seamless access to residences, offices and schools; seamless access to subways and trains; seamless identification for hotel check-in, and seamless access inside banks and at the ATM; clerk-less convenience stores; preferential treatment in retail stores; identification for government services and criminal investigations. This list of the applications is only meant to underscore that A.I. and recognition is commonplace in China, and still growing in both government and commercial sectors, to the extent those are differentiated. From the start, what is important to emphasize is how banal the use of these systems is. Perhaps there is complexity and prowess behind the scenes, but everyday interactions with these systems and services is...well...every day.

Recognition is so ordinary and uneventful that it often goes unnoticed, both to users and to researchers who are supposed to be in the field keenly observing. As a result, there were *many* times in the field when we had to ask people to repeat their use of a facial recognition system, so we could observe the process. We asked one of our early participants in the study if we could take her picture as she walked through the facial recognition system at her residence. She walked through, and we had to ask her to do it again. We explained she did it too fast for us; that we could not see the system in action. Could she do it again? Oops, we missed it the second time, and then we missed it again the third. Finally, we just asked her to walk *very* slowly, much slower than usual, and we got it. Of course, by that time a mother and her kid, an older woman, and the security guard were all looking at us like we were idiots. The guard, in particular, seemed delighted by it all. Another time, there was the look of a young man when we asked to go with him to take money out of the facial recognition ATM. You could almost see him thinking, “Oh yeah, foreigners think facial recognition is interesting? Is this a scam to take my money?” We also had to ask him to log in three times to catch the process.

Such interactions with facial recognition are very different from, indeed opposite to what we are used to with technology. Generally, with any kind of technology, whether a personal computer, phone, Alexa, Nest thermometer, car, or even Siri—we *prepare* to interact, and we remain aware of the interface, even with those that work almost seamlessly. Facial recognition interactions in China are stunning because they are so normative and normalized, often blending seamlessly into the environment. For example, three women walking back into work after lunch only briefly look in the direction of the facial recognition machines as they continue to walk and talk straight back into the building. Nothing to see here. No break in the conversation. Hardly a pause in their steps. They give a look that is less than a nod one might give a security guard that you knew very well. It is substantially less of an action than pulling out a badge, and pausing to badge in. Life simply unfolds, not only as if the technology was never there, but also as if those social regimes and routines of



observation that define so much of what we call society and culture had ceased to exist. But of course, that haven't ceased to exist, they've just been differently delegated.

Facial recognition is not just a part of high-end office buildings or residential complexes or trendy businesses; it is becoming commonplace everywhere in China. We watched as customers at a KFC quickly ordered on a screen then smiled briefly to pay. Yes, giving up money and smiling about it! In practical terms, of course, the smile is a second form of authentication for the facial recognition system to verify that you are alive (first the system verifies you are you; smiling is a secondary measure to avoid spoofing). The "smile and pay" is also common at some grocery stores. "Sometimes you can't help but feel a little happy about smiling [even if it is as a machine]" a woman checking out at a grocery store commented. Of course, she isn't really smiling at a screen. She is smiling at an Alipay system (from ANT Financial) that is part of the Sesame Credit loyalty program for Alibaba. People are aware of the Alibaba loyalty program, and some of the perks of participation. Dual systems, like the ticket/person verification system at the Beijing main train station are also popular, as lines move quickly with people being recognized, authenticated and verified by a machine, rather than waiting in the lines to get tickets and then waiting for a security person to check in before boarding. These are just normal, everyday, "nothing to see here" parts of urban life.

Beyond the mundaneness of recognition systems, people were able to articulate some advantages, and while they would raise occasional issues about use, their concerns did not necessarily impinge on the value of using a facial recognition system. People mentioned that it is more secure, is hassle free because all you have to do is smile to get access, and oh yeah, it is fast. On the surface, these seem to be values of efficiency — where ease of use and enhanced productivity determine the worth of the system. While that may be partially the case, we also believe users found meaning and significance in the fact that the use of these systems removed and obviated the unnecessary social complications often inherent in transactions. In other words, one of the (human-centered) values of these systems is the desire to avoid awkward interactions with other humans in a socio-cultural context that has weighed heavily on how those interactions should take place. While social interactions are important in China, they come at a cost. People may push more stuff at you to buy or try to make connections by attempting to leverage a transaction into a relationship. There are additional cultural factors at play here, such as those of class. Though we presume people want to interact, and that sociability is desired, that presumption may be flawed, or at least not always true or uniform. By their very personalization, recognition technologies support the capacity to elide select social encounters.

Participants in the study were expecting to see more places and more uses for facial recognition in their urban environment. Unlike the USA, there was no moral panic, in fact, people were excited and proud about what they perceived to be a highly novel technology.<sup>2</sup> There is a solid cultural belief in China's middle class that technology is both a marker and a catalyst for economic growth and national success on the global stage. The recognition systems are interpreted as markers of the development of society, at the same time they are making urban China an easier place to live, and in some respects more like the West. In a curious way, A.I. facial recognition technologies highlight the individual, a hallmark of Western culture and traditions. As one of the participants said, "If everything is connected then you can just bring your face!"



## Someone Is Watching You: Interpretive Flexibility

### *High School X: Hall Security<sup>3</sup>*

High School X, in a tier two city in China, has switched their campus security camera system over to one that uses facial recognition. The facial recognition system enables students to come and go freely on campus and is connected to the classroom attendance (check-in at the door) system. The security camera system can be accessed from any authorized desktop, e.g., security office monitors, IT office PCs, principal's PC, etc. The school used to have a bank of twelve TV monitors rotating through the twenty cameras on campus. The campus now has over forty cameras on campus for security. Two features of the system were demonstrated for us. One feature of the system was that it does anomaly detection of spaces and, when possible, identifies the person in the space (minimally captures them). Anomaly detection in this case means someone is in a space at the wrong time, e.g., in the hallway during class time. The other feature enabled a human supervisor to search by image or name in order to have all the appearances of that person for the day aggregated on screen. Taken together, these capacities enabled the detection of more than just attendance. As the following example shows, they enabled the detection of patterns of behavior, and as a consequence, revealed relations that might otherwise go undetected.

[Interview 1PM Classroom]

June (HS X Student): I've had cameras in my schools all of my life. They are watching us to protect us, but it is a little creepy. I mean, they know so much about us that they could know when you go to the bathroom or if you were dating, and who that is, really anything . . .

[Interview 3PM IT office]

Main IT guy (HS X): I think you talked to June earlier. Did she mention she was dating? Dating between students is not permitted at this school. We've known [with the facial recognition system], she has been dating for over a month. We haven't done or said anything about it. She and her boyfriend are both getting very good grades. As long as they are getting good grades and don't disrupt the community (school body), we won't interfere.

How did IT and the administration know June was dating? We don't know. Those details weren't forthcoming. We do know that the analysis of her daily patterns involved verification with a teacher, the anomaly detection, and person identification (like a game of Clue) on the school grounds. The interpretive agency in the assemblage didn't reside solely with the software but with the interaction between security, IT, teachers and the hall monitoring software.

### *Cindy Toddler Monitoring*

Cindy is raising her two toddlers in Shanghai with the help of two nannies, her in-laws, a cook, and seven in-home surveillance cameras. Cameras in almost every room are used to monitor activities and behaviors, to understand when a routine is broken, to look for lost items or to trace the root cause of a dispute.

Cindy operates a centralized system where her children are the assets and she is the processing hub. All the analytics run through Cindy who uses the cameras to collect data she uses to monitor and investigate activities in order to shape the behaviors of other actors responsible for her children's care. In one incident described during our fieldwork,

Cindy goes home to find her son and nanny are napping earlier than the established schedule. Cindy reviews the camera footage to understand what transpired and sees her mother-in-law fighting with the nanny who proceeds to retreat to the bedroom with her son. Cindy understands the context for the earlier nap time and reprimands her mother-in-law via WeChat text. When the nap is over, Cindy instructs the nanny in person about mother-in-law best practices.

In Cindy's system, the data inputs may be distributed, but analytics and decision-making are centralized. Her system's performance requires a particular set of members (nannies, parents, in-laws) to align to a particular set of values and practices (regarding food, hygiene, sleep, play) that demonstrate her version of good parenting. Cindy taps her system of cameras to access data and make sense of the actions and events that do and do not follow protocol. This constantly updated contextual insight allows Cindy to intervene and correct the behavior of the other human actors as needed to maintain optimal performance.

#### *St. Nicholas School Safety (USA)*

A similar situation unfolds at St. Nicholas of Myra, a private Catholic Pre-K to 8<sup>th</sup> grade school in a gentrifying urban neighborhood. The principal at St. Nicholas of Myra has recently deployed a facial recognition system. The recognition system is made up of humans, multiple cameras and computer technology. The cameras at St. Nicholas of Myra are used to monitor who comes in and out of the school and "to know the community better." Unlike either of the HS systems in China, the system at St. Nicholas of Myra only identifies adults, not students or anyone under eighteen. The principal and receptionist see a face and name on the facial recognition system monitors for almost every adult including the milk delivery person and the food staff. This allows the principal and the school receptionist to make sure the right people have access to the school. The system allows the principal and receptionist to identify and greet everyone by name, which they feel fosters a feeling of community. The principal sees his role as making sure the kids are "safe, happy, healthy and holy," and feels the facial recognition program helps him to achieve those goals.

#### *Ways of Watching*

Of course, the staff at HS X, Cindy, and the Catholic school principal actively manage how people act and exert power in their respective systems; a fact that is not dependent on the presence of cameras. They do so in the name of particular kinds of human value, but there are key differences in how that value is produced because cameras are present. In Cindy's case, value lies in her ability to care for her children the way that she wants through resources she has enlisted (nannies, in-laws, etc.). For Cindy, value is achieved by restricting the capacity of her nannies and in-laws to act independently of her parenting plans and goals, plus introducing the capacity of the camera to document what has taken place. In doing so, Cindy uses the camera as a means of witnessing, producing evidence that she employs, to

ends that are of her own choosing. Indeed, the camera data gives Cindy another partial view on what took place—not the nanny’s or her in-law’s. Cindy’s understanding, enabled by the camera, allows her to shape the human links between herself and her nannies and between the nannies and her in-laws (“best mother-in-law practices”). This human work doesn’t disappear; rather the presence of a camera enables it and gives Cindy more direct control over it. Conflicts may be deviations from the plan, but they also give Cindy the opportunity to work on stitching together human relationships that are central to the system.

In the St. Nicholas of Myra case, monitoring access and movement in the school increases social connectedness and an overall sense of community, but does not prevent all bad things from happening. If an unknown person or a person marked by the system (entered manually by the principal) as a “concern” tries to enter the school, the door will not open unless the receptionist or principal unlocks it. For instance, a parent suffering from substance abuse who is not currently allowed to see his kids, will be blocked by the system from entering the school. Here the opportunities for mistakes or misuse are rife, but trust is placed in the principal to make these decisions—extending his capacities to act, but still allowing him to retain authority over the system.

In China’s HS X, school administrators guard against disruption to the learning environment from both inside and out. The disruption can be at the individual or the community level. Anyone not granted access is blocked, just as in the St. Nicholas of Myra system. But this system is more proactive in monitoring internal activities. Kids skipping classes, rough housing, regular visitors going places they aren’t authorized to be, are all behaviors that can lead to a decision to act. Previously, if one of the same people had noticed an irregularity, they would also act. This resembled the system at St Nicholas of Myra, where the principal or receptionist using the camera monitoring system can spot kids hanging out under a main staircase in the school – a place they shouldn’t be during school hours. One key difference is that the camera system brings the situation to the immediate attention of security, or others if they are on the system, so action can happen sooner. The other key difference is in the ability to pull together a series of incidents over time; to create a narrative of what took place. Sam, a student at HS X, was known by the system of technology, security, IT and administration, to skip class occasionally, after checking in on the camera system. He would go out to a remote (unmonitored) part of the garden area on campus, smoke, read books, and work on his homework until the class session ended. They knew he did this because they could see him out of class and entering the garden on video. Security people learned about the smoking. None of that was acceptable behavior generally, but because Sam was one of the top students in his class and did nothing that would hurt or infringe upon his classmates, this was permitted. They school officials were willing to assume that Sam just had days when he needed to get away. The principal at St Nicholas of Myra made similar kinds of decisions when he spotted kids hanging out under the stairs, for instance. He wondered, is this just a kid trying to disappear in the midst of a bad day or are kids engaged in improper or destructive behavior? In both cases, humans continue to own the judgment about the importance of the behavior. Based on a calculation of value, they are willing to interpret and to read between the proverbial lines to explain the student’s behavior beyond what policy permits. Staff or teachers can then speak to the students about their behaviors, and so create new paths for human to human interaction. The human work doesn’t disappear, but is enabled, managed and focused by the cameras.

## Agency Denying Systems

*Steamed fish today. No chips.*

Chinese High School Z had a nutritional system that was powered in part by facial recognition. It was really not “a system,” but five independent projects built upon each other: cafeteria ordering system, cafeteria and cafe payment system, cafeteria delivery system and two different vending machine systems. Besides incorporating different applications, there were at least three different recognition software pieces integral to the system, so even the core underlying programs were not shared. When we visited, all the food a student could acquire on campus was nutritionally noted to generate a recommendation for eating. Based on what the student had eaten, the nutrition was evaluated, scored and recommendations sent to the HS administration, and the student, and the parents. The student could then determine what, if anything, they might change in what they selected to eat. However, the system was doing not always work to enable student-led decisions.

Initially, the school ran the system so that the student would have a meal at the cafeteria that was predetermined, based on a student’s optimal nutritional in-take. If the student’s optimal nutritional in-take exceeded the guidelines on one day, the system would compensate and adjust the guideline to be nutritionally appropriate on the following day. A student could order whatever she wanted as long as it fit the guidelines. In practice this meant that students whose nutritional intake was deliberately constrained might get served steamed fish in the cafeteria instead of the barbecued pork. These same students might have their access to one of the vending machines blocked. Students who mapped to the need for guidelines had virtually no agency to select their own food since the system would make value judgments and constrain decisions on their behalf.

This food selection and decision-making system for students lasted less than a month. Parents and students both complained fiercely (“after all we (parents) we’re paying for the food so our son should be able to choose what he wants”). Parents suggested to school administrators that the school should have a nutritional system similar to Sesame Credit where it would offer rewards, not punishments so students could earn points for special foods, or credits for the vending machines. The HS Z didn’t have a way to economically implement this type of system. Today, the system is designed to enable conversations. It provides students with a view onto how they are doing, from a nutritional standpoint, for the day and for the week, and on how their behavior, indeed performance, matches to the suggested standards from the government. Parents can encourage their kids to eat correctly. They can have conversations with their kids about the administration’s idea of how they should eat. Although, in the course of our research, we did not encounter any stories of parents who reported having those conversations with their kids. Finally, the students can use the report as a guide to reflect on food choices.

With respect to the cases that we observed, China’s recognition systems do not appear to be bad things. The nutrition systems, at least in one case, was redesigned to help to bring awareness to some choices, actions and behaviors; awareness that could be used to adjust behavior towards desired goals. These examples show us that recognitions systems go wrong when they act alone to deny options to humans, who have their own creativity, ingenuity and agency to solve problems. The nutrition system as it operates today has been reduced from an active agent that determines what food is consumed to an off-site coach. The lack of

malleability or flexibility for the students in the initial system created a brittle partnership which did not get traction with students or parents. Students were not learning new skills. Parents were frustrated with unseemly distinctions. Both sets of stakeholders were constrained by a system, rather than encouraged to work with it. In China, this sort of system failed.

### *Personalize It!*

Students, teachers, administrators, parents, and even IT people in the schools all talked about the hope that A.I. technology in the schools would increase personalized learning. Squirrel A.I. Learning, a private, A.I.-powered tutoring service in China, had become fairly well known as an after-school program using A.I. to generate personalized drill and practice sessions to improve students' scores on national tests. The public schools didn't have a computer per child to replicate that kind of personalized A.I. program. However, they did have cameras in classrooms. One camera set-up was tasked with taking attendance during class and it worked well. In addition to knowing who was in class, the parent-faculty-IT-admin community thought the camera and A.I. could create a better learning environment to know how the students were feeling, and in particular that it would recognize when they were "confused" "bored" or "frustrated" in class. [ENDNOTE 3] The IT-admins contacted a company to build an experimental system for them, though this didn't work out satisfactorily. The company said it could deliver an attention system that could tell whether a student was paying attention in class or not. Given that a typical class size is around fifty, this was perceived by the school as a way to ensure each student was engaged with the work (and so going to do their best). It would give the teacher insight into which students he or she was able to engage, or not able to reach. Because the key goals of the system were to 1) help students to learn more and 2) improve teacher performance, the system was assumed to cater to all classroom stakeholders. Further, for students and administrations, this would be a means to assure "no teacher bias" in the process of helping the students, or as American's might say, no favoritism in how attention is distributed to "teacher's pets."

The company provided the hardware and software. The system had two A.I. components, a facial recognition component and an affect detection component. The facial recognition was tied to the student ID data base. They guaranteed a 97% accuracy on affect detection, on the specific dimension of attention. The system had one camera mounted at the front of rooms that did an S scan every minute. The system would recognize each face and deliver an "attention" value (yes/no). Nested up at the top of a wall, it was virtually invisible, near to the camera that took attendance.

The teacher had a live report of the class activity (bottom of screen) and an overall report on the class session on his/her computer screen. The teacher was expected to be able to respond in-class to adapt their lesson in order to better engage the students. Students and their parents were sent a report with a percentage assigned to the dimension of "attention" in the class session. The students were supposed to try to improve their overall attention towards the teachers in class in the next session. The administration also had access to the reports on the class session for both students and teachers.

Parents started to complain within a couple of days about "privacy" violations of the system. At a different school there had been leaks of video footage of classroom activity by one of the school's camera systems. Some of the footage was humorous or embarrassing to

some students. Some parents were concerned that video moments when their child was “inattentive” would be caught and “escape” onto the Internet. The system had other problems that were working against it. Although no one disputed the facial recognition part, some felt uncertain that what the system “thought” and what their child was “actually” doing were at odds. For instance, some parents argued that, “My son concentrates with his head down on the desk. He is paying attention not sleeping,” because they feared their child’s behavior would be interpreted as inattentive. While verifying a student’s identity (matched to photos) was perceived to be a straightforward process by parents and students, determining attention was perceived to be an inference. It was subjective. The affect detection technology may have had high accuracy in some dimensions, but it wasn’t accurate in the way the community thought it should be. The school community discovered that it needed a human agent, such as the teacher, to interpret the data and then to take some immediate action, both for effective interpretation and action. The roles in the assemblage needed realignment. The school community learned an important point: that A.I. recognition assemblages are all probabilistic, never 100% accurate. They introduce a new kind of interaction with computer infrastructure that isn’t about 0/1, right-wrong, correct-incorrect, etc. because by definition A.I. will always be wrong at some point, in some circumstance. The community’s solution was to propose to increase the presence of the human agent in the assemblage to help negotiate value for the teachers and students.

All of these insights result in too much complexity to deal with. The affect detection experiment was quickly shut down.

The affect experiment did not work . . . we learned a lot . . . we expected too much from the technology and not enough of ourselves. . . . we’ll continue to experiment with new ways to help students & teachers in schools. . . . We’re exploring a system that can detect actions like reading, writing, raising hands . . . That might come before the next affect use - HS Principal.

The community came together to shut down this system. The system did not have a life beyond what its constituents enabled it to have. Social forces prevailed. The teachers, administration, parents and students’ still believed in A.I. recognition technology, and felt it would eventually lead to a better learning environment – a win-win for everyone. The path forward, however, was clearly going to be one of experimentation to enable more learning in the slow process of people forming new relationships with the technologies. “There may never be a perfect system, but we can do better,” said one of the IT people involved in the set-up. The community, however, still had agency to put a stop to the recognition technologies, as well as, to be actively engaged to create what the next recognition technology should be and do.

### **Perfectly Imperfect: A.I. Is Human Too**

Many of the particular systems we have discussed—eating, attention--have been part of larger systems, for instance as extended means to create better learning environments. One of the systems we explored in the USA was the use of facial recognition by a sheriff’s department. What is striking about this context of use is the lack of agency the facial recognition software is granted, and conversely, the ways in which human agency is retained.

This might not be surprising were it not for the amount of agency such law enforcement facial recognition applications are believed to have based on repeated, reports about police departments use of facial recognition leading to bad results (Brewster 2019; Einhorn 2019; Garvie 2019; Stat 2019; and White 2019). Facial recognition applications were deemed so bad that San Francisco (Thadani 2019) and Oakland (Ravani 2019) have banned use by police departments and Portland, OR (Ellis 2019) is considering it.

For the Sheriff's Department of Rock County, facial recognition software is used in a very particular way by one particular department: as a partner in a larger more distributed crime solving team. The sheriff and detectives collect video of a crime. In the case highlighted in our research, they collected video of a theft that had occurred at a local store. Sometimes the video comes from neighborhood cameras, other times from other stores' security cameras, and still other times, from both. In this case, the footage was from an in-store camera. The guidelines for the sheriff's department are very clear in that the video does not come from any city or county public cameras, it only comes from private residential or commercial cameras. Often the video from these residential and in-store cameras isn't good enough quality to be used with the sheriff's department system.

Once the video is acquired, detectives work with the agency's Special Investigations Unit using facial recognition software to see if an image of the perpetrator's face from the store's surveillance footage is a match with an image from the internal database of convicted criminal mugshots from the county system. An algorithm makes a template of the face, measures the shapes of features and their relative distances from each other. A database consisting solely of convicted persons' photos from the county is then searched as the source of potential candidates — not photos from the Department of Motor Vehicles, not Facebook, not traffic cameras or the myriad streams of close-circuit TV video from around the city. What's more, facial "landmarks" are compared without reference to race, gender or ethnicity.

After the software generates a list of possible matches, an investigator assesses their resemblance to the suspect. Typically, there are 5 multiple hits. There is nothing visible to the investigators on the accuracy of the hits—it is simply a list of 5 previously convicted individuals who might be a match for the person in the video. The county realizes that the system is not perfectly accurate. Sometimes, the team decides none of the mugshots is a correct match. If one or more is selected, a review is conducted by detectives and supervisors, noting similarities and differences. If a person is selected from this list, that person becomes an investigative lead. The identification team will provide only a single lead to the case detective. If they affirm a match, the detective proceeds with further research, pursuing it like any other lead they would get, e.g., an anonymous caller, witnesses at the scene, 911 call etc. Notably, no one can be arrested on the basis of the computer match alone. For an arrest to happen, there must be traditional verifiable evidence of probable cause for an arrest. As such, the photo match does not count as legal "evidence." The facial recognition system is "just one input among many in our 100% human driven investigations" said one of the identification team members. His colleague added, "it provides a simple solution to an otherwise-tedious hunt through photos." And while the facial recognition doesn't count as evidence, the investigators see it as at least as reliable a lead as some eye witness accounts.

Other police departments in the USA have tried to give facial recognition systems more power in the police force, as is the case in Orlando, but they have been shut down (Stat

2019). Raji and Buolamwini (2019) examined all commercial facial recognition systems in the USA and highlighted the flaws and inadequacies of the systems in addition to fundamental injustices perpetrated by those inaccuracies. The assumption in these understandings of the facial recognition systems is that they need to have closer to perfect accuracy, operate independently of humans and have trustworthy value. This sheriff's office is an interesting case in that it assumes the system isn't perfect, just as the sheriff's deputies aren't perfect, and so sets in place a series of procedures to account for [non]human frailties. Technology-human interactions are frequently reduced to being thought of as issues around trust. Trust seems inaccurate to describe the role facial recognition technology is playing. The system has the accountability to discover the suspect, and because the system has many agents in it this accountability is necessarily shared. The 'black boxing' (Crawford and Schultz 2013) of the recognition system, or the investigator, or the detective, or the eye witness, etc. is not crucial as it is part of a distributed system of action.

## FRAMEWORK FOR THINKING ABOUT RECOGNITION SYSTEMS

We have demonstrated a range of uses of A.I. and recognition assemblages. While still new and "cutting edge", it seems clear to us that these systems are rapidly becoming a commodity infrastructure that even small businesses will be able to build new applications upon. Across the research, we identified seven variables that give us a way to start to account for how these assemblages work and when and why they stop working:

Explicit permission. Does the agent give permission to be part of the system and know? Is it voluntary? Is the person aware of what is being recognized and why? Or is the hidden and unclear?

Recourse – is the path to correct any problems clear and reasonable. Recognition is probabilistic, which means at some point it will be wrong. Knowing this, having an actionable course of action when things are not right is important;

Consistent – is the system deployment consistent with the institution's stated business interests?

Personally Efficient – is the system deployment easy and does it achieve something of value for those being used as data. Of course, there can also be some broad community value (e.g., community health or safety). Or even more distant, the recognition is generating value for some other entities benefit;

Anonymized – are the data anonymized? is any personal identifiable information necessary to participate? Is it possible for the system to deliver personalized results if the information in the system is anonymized?

High Confidence – all recognition systems are probabilistic, though some are better than others and some instances are more difficult to determine. This measure looks to whether the use case will have high confidence or a high threshold in determining the result. At the extreme other end would be a system that requires human agents to make a determination.;

Self-contained – does the information stay within one domain or does it leak out to other domains, (e.g., residence access recognition isn't used in any other way and stays within the resident community's system)?



What follows is a brief introduction that applies some of these variables to show how the different assemblages using recognition software are distinct. We'll provide three examples to help draw out the differences between these variables, how they work and how they work together.

## HS Access Facial Recognition

Our HS X used facial recognition to allow people (students, faculty, admin etc.) onto the grounds. The access set-up is very explicit and obvious. People give their permission to be part of it or if they opt out, they can use their ID cards to enter (albeit a slower process). If they are not recognized and blocked from entering, then they can see a security guard in a nearby booth and pass through with an ID. Knowing who is or who isn't on campus is considered part of the school's responsibility to students, staff and parents. By simply walking into school, it has eliminated long lines and wait times as people used to have to show their ID cards to guards and if their ID cards were lost or misplaced, it turned into an ordeal for people and the administration. There is no anonymization. The location and time of the person passing are noted for the daily records. There was high confidence that the recognition system would work since the data base was less than 1000 people. The data base and the results were contained to the school system only, which was an on-premise system. The mapping onto our vectors can be seen in Figure 1.

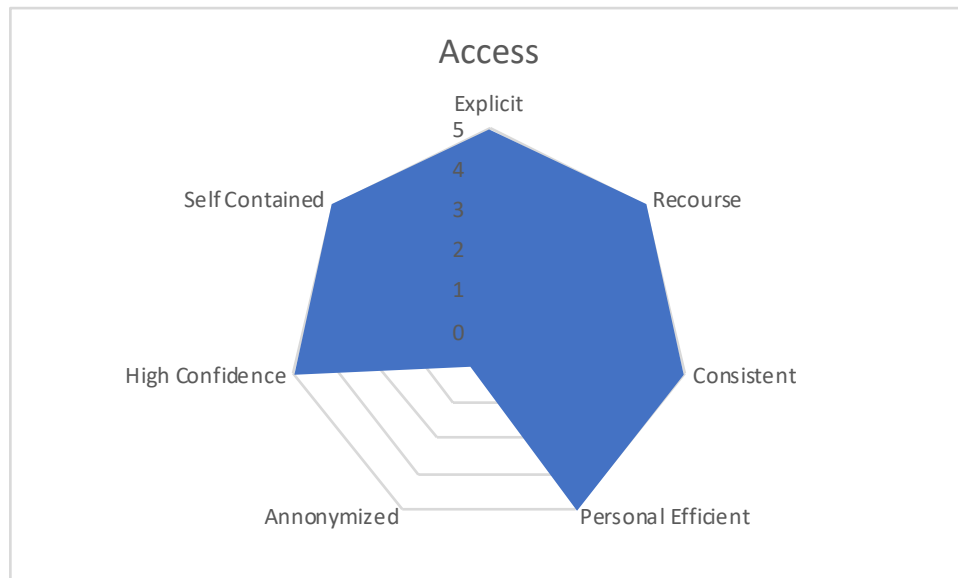


Figure 1. Access to School Facial Recognition Mapping

## HS Affect Detection

Affect detection, though taking place in the same context, a school, has a very different profile than access to the campus grounds (Figure 2). While the explicit permission to be part of affect recognition might on the surface appear similar, it varies from the access example because the cameras are mounted up and away from the students. Because the cameras scan the entire room, one is never sure when they are being monitored. There is little recourse to the affect result – neither the student nor the teacher can know when affect moments happen, so they can't be contested or corrected. Because the classroom experience is about paying attention to the teacher, people felt it was an appropriate thing for the school to try to work to improve. While in theory there was value to the student and the teacher, neither was actionable value. The net result ended up being uncertain value for everyone. The recognition was directly tied to identified individuals who were given reports. The quality of the data set for what constituted attention/not attention, as well as, how behaviors were interpreted, was highly suspect. Video was accessible off campus by parents and the partner company.

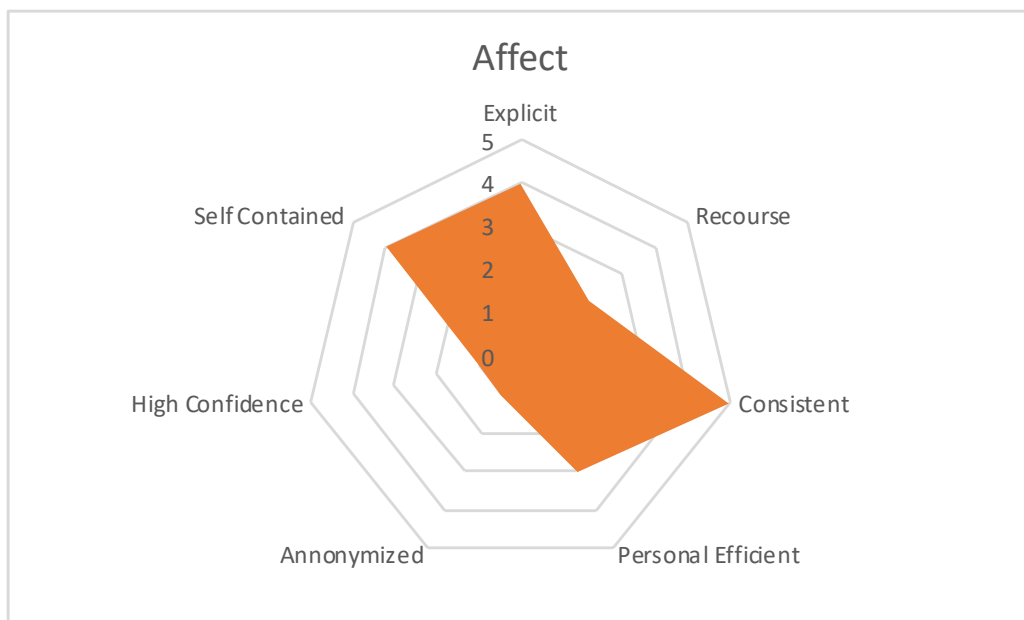


Figure 2. Affect Detection In Class Mapping

## HS Hallway Recognition

Hallway recognition creates a slightly different profile than either of the above (Figure 3). While it too takes place in a school, it has a very different profile. While the explicit permission to be part of a hallway recognition might on the surface appear similar, it varies from the access example because the cameras are often mounted up and away visually from the students, almost hidden. There is little recourse relative to the hallway detection result –

moments are collected, but not necessarily immediately acted upon. Counts of activity can be made, without the video being retained. The IT person and/or security person have the dominant voice in interpretation. While administrators and teachers felt the system was consistent with the schools goals (safety, attendance, & learning), many students understood the safety and attendance aspect but felt the school should primarily be concerned with campus access and what happens in the classroom. The students did not see any personal value to the system. Overall the community value was insuring no misbehavior on campus creating a safer social and physical environment. There was no anonymization of the data – data was tied to an individual or individuals. It was recognized by all participants that both the recognition of the individual and of the activity were subject to a lot of interpretation by IT and security personnel. The hall recognition system was contained to the school environment with security access given only to particular people with particular roles in that school.

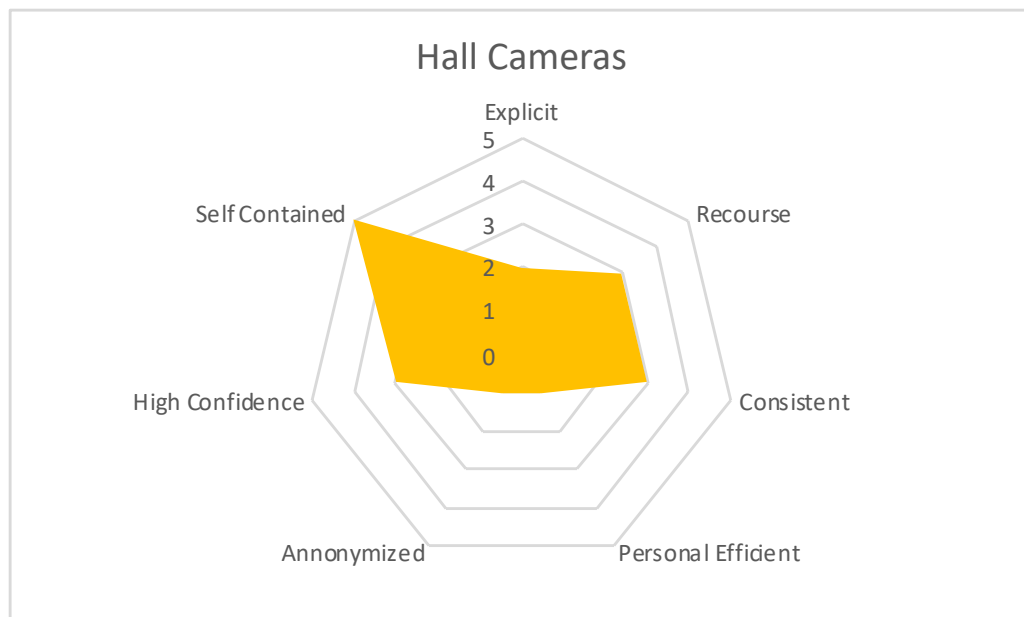


Figure 3. Hall Cameras in Recognition Mapping

While the diagrams provide a “systems approach” to think through recognition technology uses for those we have discussed and others that might emerge they are ultimately incomplete models. Specifically, these models do not address the important differences between A.I. (instructions, intentions, revealed preferences, ideal preferences, interests and values) on an individual or a collective basis. A challenge remains for researchers to identify fair principles for alignment on recognition technologies that receive reflective endorsement despite widespread variation in people’s and communities moral beliefs.

## DISCUSSION

All of the assemblage involving recognition software described here can be cast as providing for well-being, broadly construed (or at least that the intention by those who use them). The form and content of well-being differs from instantiation to instantiation, in some cases they seek to provide security, in others, health, in others a sense of comfort. In many cases, these forms are swirled together. They strive towards a holistic environment or milieu, characterized by values and desires that are projected into and through these systems. Surveillance is offered as the tool, the means to achieve that well-being. This is not, in fact, such an odd perspective. Regimes of observation, inspection, and supervision have long been part of how we, as individuals and societies, work towards well-being, whether through a disciplinary gaze or an ethics of self-care (Foucault 1995). What differentiates these regimes is the assemblage that enacts them and with which that we interact. Contemporary assemblages, such as the recognition systems we've discussed, display (if not possess) agencies of their own, capacities to act and exert power in dynamic ways that are new and unfamiliar. This requires that we do more than extend the existing theories of observation and control onto these assemblages. This requires that we work to articulate new theories that engage the agentic capacities of these assemblages.

These agentic capacities are apparent in the tailored character of these assemblages; the well-being generated is not generic. The aim of these assemblages is a well-being that is personalized in ways that people find meaningful. The subjectivities of the consumer are different from those of the citizen, which are different again from those of the student. These subjectivities are also always intersectional—the Chinese mother and the parochial school principal are complex inter-weavings of the social. Personalization then is more than a surface acknowledgment of the differences between one individual and another in order to deliver recommendations that cater to demographic differences. The rhetoric of personalization in an age of A.I. is about new sources of everyday benefit and fulfillment, enabled by new types of partnerships that bring new types of distance and intimacies into our relationships with other humans and with technologies; partnerships that help us to produce the worlds we want to inhabit. Of course, we can and should question this rhetoric, but the point remains, personalization in the age of A.I. is not the transactional customization of Web 2.0.

While the research represented here is limited, the socio-material change in the definition of “the field” brought about by recognition systems strongly suggests the need for new or modified approaches for doing innovation work. We see at least three aspects of our work that could be (re)considered: 1) assemblages, not individuals or user experience; 2) where we get our models for A.I. networked systems; and 3) the necessity of a humanities approach.

### Assemblages, Not Individuals or Groups

As a community of practice, we should consider a shift in our lens from the individual experience to the collective, technical, institutional, and regulatory systems that surround peoples who exist in networks of assemblages. Studying “users” as we have traditionally conceived of them will be of limited help in understanding the transformations that A.I. and

recognition will enable or force in society. Our familiar ways of thinking and working are likely to limit themselves to the failures of a particular instantiation of a particular system in existing socio-technical contexts as we know them. But this will not be helpful for understanding the contexts that are emergent from A.I. assemblages.

It would be a failure to think about the principal or parents or students or teachers or security staff or IT personnel as being the only generative actors here. The technology, government, markets and institutions create affordances that enable particular kinds of agency, which in turn interact with those technologies. Ethnographic traditions like those that emerged following Geertz in anthropology or The Chicago School, like Howard Becker, in sociology, wanted to account for the larger frameworks that guided action and understanding (cultural in the first, social in the later). Following in those traditions, we see, for example, the user plus the direct user experience plus the use of one or more A.I. programs plus the policies of the Chinese government plus market forces (implicating companies like Hikvision, Intel, Alibaba, Baidu, etc.), as well as incentives around efficiency (what we think machines could do) – all as part of what we’ve referred to as the A.I. and recognition “assemblage.” In this context for research, the individual user, or for that matter, even the notion of a group, should be re-cast as an assemblage, which encompasses all of those who use or would be affected by the use of the system, imbricated with multiple cultures, practices, institutions and markets. We do this not by forcing us to see how this stuff affects individuals, but how this stuff *is* the assemblage.

*In the end, the importance is not that the A.I. has its own agency, nor that users make A.I., but that A.I. is making new kinds of people, individuals and society (among other things).*

Some might suggest that existing methodologies, like Actor Network Theory, offer this opportunity. While such methodologies are a potential starting point, what’s really needed are methodologies that enable us to be more anticipatory of how value might be created, and less analytical of how valuation has already occurred. For instance, as we partner with these systems, we need to develop an appreciation for new modes and experiences of agency. Agency has never been reducible to the capacity for human action alone—as if people were ever able or willing to act independently of the worlds they make and inhabit. Capacities for action and exerting power are an outcome of an intermingling between people, other humans and a multitude of other things. Agency is a quality and effect of networks. Here, Actor Network Theory is a useful starting point. ANT posits that what we consider to be the social world is a constantly shifting series of relationships of humans and non-humans of varying scales that function together (Latour 2005). What is distinctive about this method is that it does not privilege humans within the network. Agency is not a quality of any individual actant but rather of the configuration of the network. As that configuration is dynamic, so too are the agencies within that network.

Another important aspect of agency within ANT, which distinguishes it from many other perspectives, is that agency does not require intentionality. So, for instance, in discussing the issues of restocking a bay with scallops, it is fair to describe the ways in which the scallops themselves are actants and refuse to participate in this process (Callon 1984). Such a flattening of subjectivities and ontologies is disturbing to some social theorists, but precisely the point of ANT: to de-center the human and consider an expanded perspective on how the world is made and then made to work. Proponents of ANT are quick to point out that ANT is less a theory of the social and more a method for tracing the associations and processes by which what we call the social comes into formation and actions. Given its

attention too, indeed its embrace of, heterogenous collectives of humans and non-humans, ANT has proven to be particularly useful for the description of contemporary conditions in which objects and systems regularly are taken to be acting in and on the world.

But ANT alone is not enough. In fact, ANT may not be the most useful starting point in a world populated by A.I. algorithms and socio-technical networks. ANT is an analytic tool that allows us to describe the world, after it has been made. It is less useful for understanding the world *as it is being made*, and perhaps totally unhelpful as a framework for making the world as we might want it to become. What is needed are practices and theories that enable us to better imagine how the world might be made—concepts of networks and agency that help us to explore the distance and intimacies that we have to deal with today; concepts of networks and agency that are imaginative, exploratory, and speculative but also grounded in fundamental humanistic principles based in the possibility of relationships.

### **Contexts as Models Of and For – Beyond the Literal**

While we considered many different A.I./recognition systems as they were being deployed, we were reminded of a key direction for innovating new communication and information systems, that is by researching those that have been around for hundreds of years. This is a radical departure from traditional research for what has become classical UX and innovation work that looks first at the immediate and literal context of use as a site for product/service intervention, followed by work on ever more specific requirements for said product or service. If you are creating a product for baby food or travel mugs or working on how to make a better Xerox machine, this may have been adequate. But communication and information assemblages may or may not be modeled in the intended context and the variables that need to be contextually informed have more to do with data flows than actual sites of use. An alternative in the innovation process could be researching cultural contexts and systems that can illustrate the data flows and exemplify the goals of the system to be designed. In short, some research needs to take place outside of literal context in order to find its actual context.

So, if you want to create an A.I. recognition system that might get used in a stadium or an autonomous vehicle, looking at the actual context of use may not necessarily be the best place to ground the research. Instead, exploring a site that has characteristics of a robust and intelligent network might generate new ways of thinking. For example, researching the medina networks in Morocco may provide new ways of thinking about the kinds of resources that computational networks will have to make available. In these markets, we can see how tourist networks learn to interact with existing networks of vendors and local guides. These kind of research sites might provide a better model for a smart network or pulling together an assemblage, than looking at the actual classroom, where that same technology in question is meant to be deployed. Human systems are incredibly innovative and time-tested and are often ignored as “systems” and reduced to literal contexts, actual contexts of use. To paraphrase Geertz, we shouldn’t be limited to creating models *of* some particular context of innovation but also models *for* innovative systems. Separating the models for design from contexts for implementation invites new perspectives and frameworks for innovating complex assemblages of solutions.

The shift from individuals to assemblages, the changing character of what we once referred to as context also suggests that, as a community, we need to broaden the theories

and methods we engage in, while also parting ways with techniques that no longer serve us. While there is an ongoing need for researching human cultural contexts of use, there is a limit to what we can understand by observing the use of these systems by people, in part because so much of the system itself is not encountered by humans in use. To better contribute to a vibrant imagination of how the world might be made, we need to complement our practices of observation with practices of interpretation. Thus, another implication is the need to draw theories and methods from the humanities to better understand these systems. What do the humanities offer? Certainly, more than empathy. What the humanities offer are ways to interpret the things that humans make—“readings” of many kinds, close readings, distant readings, reparative readings, deconstructive readings, and so on. These readings are also designs in the sense that they are acts that organize ways of life, ways of living in the world. They provide a critical lens into the systems that claim to produce meaning and even knowledge. Importantly, these acts of reading are fundamentally different than observing what humans do. We tend to think of the humanities as providing skills for the interpretation not just of poems, literature, paintings and such, but of video games, logistics systems, algorithms and new categories of texts that provide the means to be human in a more-than-human world. To develop a fuller appreciation for what these systems are, and might be, we need to continue to develop practices of ethnography in an expanded field, which recognizes the need for, and the limitations of, human-centered in a world comprised of artificial intelligence, and looks to bring practices of interpretation to the fore.

In addition, recognizing the limitation of how we study these systems and their contexts of use, we should also acknowledge limitations on how we communicate our research. The techniques and tools of representation we have used in the past seem worn and shredded as we take on these dynamic assemblages. Many of these techniques and tools were developed in the context of human factors, in the context of designing interfaces for systems in which there were material affordances or the ability to create facsimiles of material affordances. What is more, most of these techniques and tools place emphasis on the individual and their interactions with a system that is bounded. But as we’ve discussed, that is simply no longer the case. It is not enough to tell the story of a system from the perspective of a single person, or a single product, and it may not even be enough to tell the story of a system from a human perspective alone. Personas are likely inadequate to capture a recognition program. A use case fails at articulating the value, dynamics, and complexity of education in the classroom. How do we tell stories that are polyvocal, wherein some of those voices are not-human? How do we represent dynamic configurations of agency?

## CONCLUSIONS

We have presented glimpses into a subset of processes in which social realities are becoming realized in and around recognition assemblages. These glimpses start to show how it is that verbs of doing become nouns of being (to watch, am watched). It is a start on a longer pathway of discovery on how our lived worlds are pragmatically produced, socially construed, and naturalized. In many ways, A.I., beyond ML, is still so abstract, diffuse, and unknown. In this paper, we have tried to shift the conversation from the potentially soteriological or cataclysmic possibilities of A.I., to what is firm, clear, steady, and tangible; moving beyond just something that is more “what might it be” than “what it is.” Rather than

considering A.I. hypothetically in all of tomorrow's futures, our interest has been to examine A.I. as it is instantiated, experienced in practice and culture today. Only by capturing moments now, are we able to understand how A.I. among us is creating new kinds of individuals, institutions and society.

In the end, there are many questions about what exactly are the problems in contemporary A.I. systems for social sciences and how to investigate them ethnographically. It is not as if the social sciences are just coming to A.I. —there are decades of work to build from on social-material systems. And yet, our contemporary A.I. systems seem to be distinct in the ways humans are instrumentalized for the sake of nonhumans. The human action is material for the nonhuman algorithm. The kinds of assemblages that A.I. is bringing together challenge us to consider what our practice is and how ethnography matters in it. Are projects studying the engineer working on algorithms in a cube or software teams in a lab going to be enough? Anthropology started as a study of “man” <sic> the animal, in an evolutionary and comparative framework. Today, we are shifting over to an understanding of people in a cybernetic framework; an understanding of people as machines with nerves. New instantiations of A.I. challenge us to consider what it means to be human, or nonhuman. It pushes in a direction complementary to “multi-species” ethnography (Kohn 2013) or anthropology beyond the human (Besky and Blanchette 2019). These new A.I. instantiations also suggest new ways to frame and do our work. Considering possibilities of following data flows, like Mintz (1985) did with sugar, or considering assemblage subjectivities, instead of just individual ones. To understand the implications of these assemblages to the human, we have to better understand the nonhumans. The anthropological project around post-human This requires experimentation new ethnographic techniques (Seaver 2017).

With this massive and yet occasionally quiet shift slowly but surely taking place, we have the opportunity to reflect on our roles as corporate social scientists, humanities thinkers, ethnographers, design researchers. We have choices to make about the degree to which we will continue to work to improve the technologies, services and assemblages that continue to expand the role of A.I. in our daily lives, or if we will work to slow down the rate of adoption, in some cases, going so far as to argue against it. Neither these technologies nor our study of them is neutral. While we should remember that we've been here before—with the invention of electricity, automobiles and even television—we recognize that A.I. systems and assemblages are different, more invasive, and place into check values and principles that humans have claimed for themselves. It's another crossroads for our applied disciplines and our shared interest in ethnographic work. Perhaps instead of posing the options as binaries—as choices we each need to make to advance one option at the cost of the other—we can work to improve *and* to slow down and in doing so to recognize that these two paths more than likely coincide at every step.

## NOTES

Acknowledgments – We'd like to thank all the people who gave us time out of their busy day to share their thoughts, stories and experiences with us. We'd also like to thank the institutions that opened doors for us and welcomed us into their communities. Finally, we'd like to thank Ellie Rennie, our EPIC curator, for her truly helpful comments and support.



1. We will draw upon research primarily from China with some comparative or contrastive sites in the USA. Pseudonyms are used throughout this paper. The research in China was conducted in 2018. We spent two weeks surveying recognition programs in public use in Beijing, Shanghai and Hangzhou. Primarily these were one on one around particular recognition programs, e.g., access to banking, access to work, smiling to pay, etc. While trying to understand how the systems were used (and others they used), we also explored the broader context of their lives. We returned 6 months later and spent 10 days to do deeper dives around recognition systems in educational institutions. We primarily focused on 3 high schools: 2 public and 1 private. The schools discussed in this paper are both public schools. One school was one of the poorer ones in the district, while the other was situated in a university community. All the recognition systems discussed were not yet commercial systems. At the schools, we interviewed a variety of stakeholders: teachers, administrators, staff, students and parents. Independent from the interviews at schools, we talked to representatives of some of the companies that provided the systems to the schools. The school administration asked that their schools names not be used in any report. Likewise, all the participants in the research have been anonymized. None of the systems created for the schools in China were products or services at the time we did our research – they were experiments. High School Z uses a team of parents, teachers, staff and administration to brain storm uses for new applications that they want to bring onto campus. The administrator and IT lead try to find (large or small) companies interested in creating the system for the school, creating public and private partnerships. The public schools in China, in general, when we were in doing the research, had no guidance for systems to build, buy or deploy – everything was an experiment. The research in the USA was primarily site visits. We visited the sheriff's department in May of 2018 and the St Nicholas school in March of 2019. The facial recognition software used by St Nicholas is a commercial product. The former was done as a part of the exploration of landscape of uses of facial recognition. The later was conducted as a point of comparison to what we had seen in China.

2. When we were in China, the stories about facial recognition systems being used on the Uyghurs had not become content of mainstream media in the USA or China. The stories of facial recognition that were circulating were about people being ticketed for minor offenses (e.g., jay walking), dispensing toilet paper, and criminals being identified and/or caught on the street (or at events), authenticating appropriate car service drivers and so on. The camera surveillance system was primarily explained in terms of safety and civic etiquette, reinforcing the way people were to behave, protecting against those who violate etiquette and laws. No one we talked to wanted to see less recognition systems in place, most had ideas of where they wanted to see more, e.g., “ticket dog poopers who aren't scoopers” “find my child” “reward appropriate behavior in Starbucks (throwing trash away).”

3. As mentioned, the recognition systems in schools should be considered experiments. The affect system was an experiment to create a better classroom experience for learning. For those in the USA, the in-school experience is a little different, particularly when looking at something like affect detection. The value of the student is judged more on how he/she/they perform on the national exams than on grades in school. Every class I saw, someone slept during class. The reason given was they had been studying non-class material for the national exam until late in the night and were tired. All students and parents talked about the use of materials from outside of the school work to help them with the national exam. The import of the exam vs the school plays out in the various systems in that the evaluation of the system about the student (attentive or not) does not really impact the student as much as such a system might in the USA. Of course, everyone wants to score well on everything, however, whereas a grade in a course might greatly affect a student's future in the USA, the national exam would affect a student's future in China. HS X, in part, was using the affect system to try to create a more dynamic learning environment for everyone, in the hopes of improve the overall performance on national exams from their students.

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## Calibrating Agency

### Human-Autonomy Teaming and the Future of Work amid Highly Automated Systems

LAURA CESAFSKY, *Alliance Innovation Lab – Silicon Valley*  
ERIK STAYTON, *Alliance Innovation Lab – Silicon Valley, MIT*  
MELISSA CEFKIN, *Alliance Innovation Lab – Silicon Valley*

*This paper explores how the design of everyday interactions with artificial intelligence in work systems relates to broader issues of interest to social scientists and ethicists: namely human well-being and social inequality. The paper uses experience designing human interactions with highly automated systems as a lens for looking at the social implications of work design, and argues that what human and automation each do is less important than how human and automation are structured to interact. The Human-Autonomy Teaming (HAT) paradigm, explored in the paper, has been a promising alternative way to think about human interactions with automation in our laboratory's research and development work. We argue that the notion of teaming is particularly useful in that it encourages designers to consider human well-being as central to the operational success of the overall human-machine system that is being designed.*

To think in interaction with a computer in the same way that you think with a colleague whose competence supplements your own will require much tighter coupling between man [sic] and machine ... than is possible today.

- J. C. R. Licklider, "Man-Computer Symbiosis" (1960)

## INVENTING AND CALIBRATING A HUMAN-AUTONOMY TEAM

An operator sits in front of a giant, curved monitor on an otherwise Spartan white desk. With mouse and keyboard, she interacts remotely with an autonomous vehicle (AV) out on the roadway that needs, and has 'called for,' her help. The AV 'wants' to go around an obstacle—a double-parked delivery vehicle—that impedes its progress, but it is not sure if it should. The young woman clicks a series of buttons and, in response to her input, the car cautiously edges out, crosses the double yellow line, and drives around the obstruction to continue on its journey. This action may not seem like much, but our operator has just engaged in a delicate ballet of Human-Autonomy Teaming ("HAT" for short).

This paper explores how the design of these everyday interactions with artificial intelligence in advanced work systems might relate to broader issues of interest to social scientists and ethicists working in technology, such as human well-being and social inequality. It draws ethnographically on our experiences working intensively with engineers in an AV Innovation Lab to design how agency in collective problem solving will be distributed across human and non-human agents in SAM, our Seamless Autonomous Mobility system. SAM supports the remote management of fleets of AVs in times of trouble; one of its chief value-adds is the ability to bring human intelligence into an otherwise-automated technical loop in crucial moments. Yet exactly how, when, and why the intelligence of this "Mobility Manager" should be engaged via SAM has been the subject of

intense speculation, experimentation and debate among the multi-disciplinary researchers in our lab. We refer to this contested process as *calibrating agency*.

Our essay is situated amid this contest over the proper calibration of the Mobility Manager's agency in the SAM system, and in response to a growing body of scholarship at EPIC and elsewhere on automation, human work, and the 'end of the job' as we know it (e.g. Cefkin et al 2014; Yapchaian 2018). Our contribution is to offer new insights on the topic of meaningful work in relation to current debates about automation.

Our first overarching theme is that we should not associate automation only with humans being tossed "out" of the technical loop at work (Bradshaw et al 2013; Gray & Suri 2019). As serious as the issue of worker displacement is, in our work we have experienced the other side of the coin: that purportedly automated technologies like AVs do in fact need human workers and their human agencies "on the team" and "in the loop" during real-time operations in order to function. The growing need to invent jobs for technologies formerly thought to be "automated" presents a practical and intellectual opportunity for ethnographers and others working in technology to attempt to influence the automation process towards more humane outcomes. To succeed at this task we will need hybrids: of human and machine, of research and design, and of academic and applied sensibilities (Blomberg 2005).

At work in our lab, as we detail in the body of the paper, the question of what the Mobility Manager ought to do to help in AV problem-solving has often been figured in terms of "role" rather than automation paradigm—that is in terms of *what* rather than *how*. Should the operator be deployed as a "social-knower"; a "technical band-aid"; an "AI machine trainer"; a "legal actor"? The paper uses the example of the Obstructions use case for SAM (which appeared in our opening vignette) and these four different roles as a way to unpack what Teaming means in terms of 'how' the operator is imbricated in highly automated systems, and the challenges that different paradigms raise for worker well-being.

To that end, the second overarching theme of the paper is exploring Human-Autonomy Teaming as an emerging automation paradigm, and a framework for designing the SAM operator work role toward more ethical outcomes. HAT is a human-machine interaction paradigm focused on creating reliable and efficient interfaces for managing human-autonomy interactions in safety-critical decision-making systems. Yet we describe how the optimistic ethos of Teaming—"bring the best out of each teammate, human and machine alike!"—leaves practical space to research and advocate for operator workflows that consider issues like worker alienation, culpability for system error, and the growing rift between 'haves' and 'have-nots' in high-technology economies. Dealing with these problems, we will suggest, means not simply giving the worker "more" agency with respect to the machine, but instead attending to the intricate details of implementing collaboration.

## HISTORIES OF AGENCY IN THE DESIGN OF LABOR

While the business rhetoric around AI, machine learning, and predictive analytics argues that human beings can be *eliminated* from a wider and wider range of tasks—and profits and user outcomes thereby improved—, we know from a long history of automation studies that the reality is never this simple. Human roles and agencies are displaced, shifted in time and space, but not simply eliminated or made obsolete (Mindell 2015).

Labor automation is at least as old as the wind and water mills of the Middle Ages. Something close to the modern rhetoric of high automation can be found already in Oliver Evans's "fully automated" grist mills of the 1780s: romanticized descriptions of this mechanized production line for grain consistently downplayed the roles of human tenders in management, maintenance, and implementation (White 1962; Smith 2016). Taylorism and the assembly line are the better-known successors to the Evans Mill, and made more explicit the roles of the human being within the automated system: to be part of the machine oneself, performing a rote labor process in a precisely choreographed way; or to be a machine engineer, ensuring the automation does its job and carrying out via machine technology strategic decision-making tasks (Taylor 1911; Diebold 1959; Aitken 1960).

Cynically, then, automation has two different valences, from two different subject positions. For some, what it means to have agency in an increasingly automated world is to be a human body that is itself a tool of technology: instead of technologies being 'mediator[s] between man and the world', humans become mediators between technology and the world (Simondon 2011). Such is the world of the machine tender. For others, agency is increasingly expressed by wielding machines: designing them, ordering them about, and using them (along with their associated human tools) to free up more time and energy for creative work (Noble 1984). Such is the world of the engineer or manager. This dance of "managerial" and "shop-floor" agencies, mixed in with the agencies of machines, continues everywhere from Shenzhen to the surface of Mars. We see it show up again, as we explore in the body of the paper, in contemporary automation paradigms like microwork and supervisory control that are proposed for real-time oversight of 'autonomous' systems.

HAT inserts itself into this "master-slave" dualism, where one is either ruled by or rules the machine, with the dreamy-eyed proposition that the most effective way to enmesh humans and AI is to make them equals of sorts—to "team" them. HAT is therefore the spiritual successor to J. C. R. Licklider's 1960 vision of human-machine symbiosis (Licklider 1960). HAT emerged from human-machine interaction literature, and especially from research in the aviation domain, as a field of technical specialty. It makes the argument that, especially given the complex domains in which automated technologies aspire to operate today, outcomes are less effective when human operators have either too much or too little agency, or when automation relationships are rigid, as with Taylor's assembly lines (Brandt et al 2017; Endsley 2017). Teaming tries to retain the benefits of automation—mainly, efficiency—while minimizing two of its chief costs and hazards—especially brittleness (the inability to adapt to new situations and contexts) and alienation of the operator (Shively et al 2017). The promise is that, on a team, neither humans nor technology become the tool: rather, they work together creatively to solve increasingly complex problems.

Behind this optimistic rhetoric lie sober research problems that AI and HMI researchers are just beginning to tackle. There are very many practical and technical questions of team-building, and a growing research agenda on the philosophical and pragmatic implications of machines as teammates—both from the robot and the human ends (Schaefer et al 2017). After all, effective teamwork is an intricate engineering challenge that requires generating "actual coordination of complex activities such as communication, joint action, and human-aware execution to successfully complete a task, with potentially shifting goals, in varying environmental conditions mired in uncertainty" (Seeber et al 2019, 3). Because with HAT neither roles nor tasks are defined in advance, and because finding the optimal form of



‘teamwork’ is an experimental problem unique to each system, HAT affords—and requires—a more inventive *calibration of agency* than other automation paradigms.

The definition of agency is a central, contested concept in philosophy. In deploying the term we risk entering relentlessly muddy waters, and do not seek to resolve the contest. Rather, we endeavor to define only what *we* mean practically when we speak of agency in work design and in relation to the machine. We forward a minimalist definition of agency, drawn from Actor-Network Theory and science studies: agency as the simple capacity—shared by humans and non-humans alike—to alter the course of events in some situation. Agency can be recognized by asking the following of an entity: “[d]oes it make a difference in the course of some other agent’s action or not? Is there some trial that allows someone to detect this difference?” (Latour 2005, 71). We might also glean this in the reverse: if the human is inserted into the loop of automation only to supervise or “rubber stamp” automated processes that would have unfolded exactly the same way in their absence, then we can conclude that they are not exercising agency. This definition of agency thus does not say anything specific about the concerns of the classic philosophers of agency—the more humanistic visions that worry about the place of human will, intentionality, reason, and self-realization (Kockelman 2013). Yet we do reunite with that tradition in a more obtuse way, in the sense that we are interested in how automation paradigms like HAT might produce more engaging and reasonably remunerated jobs that might allow a worker to lead a dignified life and, to the extent possible, influence the direction and possibilities in her life.

## OUR WORK AT THE INNOVATION LAB

The automobile industry is by outward appearances a paradigmatic case of the automation of human labor out of an existing system. Indeed, in the earlier days of the AV industry, many of the bigger players operated under the assumption that the software would entirely replace human oversight (Markoff 2014). However, as technological setbacks have sobered the industry, this attitude has shifted, and exploring human-in-the-loop technology has become *de rigueur* (Harris 2018; Davies 2018). History shows us that this should be no surprise: technologies that are autonomous inside the lab regularly involve humans-in-the-loop by the time they leave it. Examples from spaceflight have shown the continued need to involve human judgment and flexibility, whether in person (Mindell 2011) or at a distance (Clancey 2014).

As researchers at a major manufacturer’s AV Innovation Lab, our everyday work is mostly about how to keep various humans “in the loop”: aware of, in-step with, and in seamless and positive interaction with the purportedly “autonomous” vehicle systems we are creating. Especially driven by the director of Nissan Research in Silicon Valley at the time, and the principal scientists for Autonomous Vehicle development—both of whom had come from NASA—our AV lab was perhaps unique in that there was an early and strong belief that autonomous systems would always need humans in the loop somewhere. Or, at the very least, they would be needed for quite some time to accelerate the process of getting AV on the road. The Seamless Autonomous Mobility (SAM) human-in-the-loop vehicle management system has been one of the main research efforts at the Lab from its opening in Silicon Valley in 2013, and it was constructed around that same intuition.

Yet this conviction that a human-in-the-loop is necessary was, and still is, an article of faith first. What exactly humans are needed in the loop to do remains an object of

considerable debate. There is a gestalt sense that we need humans to make automation work, but debate and shifting positions over the projected capabilities of machines—and therefore controversy over the required roles for humans in automated systems—is abundant. This is in part because of uncertainty about what AI will and will not be capable of in the future: it is a ‘teammate’ whose future skills we can only guess.

As social scientists designing for the roles of these humans within the vehicle system, we have been in the thick of things as active participants in the *interesement* and *enrolment* of actors into these sociotechnical visions (Callon 1984). We have been working closely with multi-disciplinary teams of engineers and designers for several years to create a work role for the Mobility Manager within the SAM system. This work has involved studying analog fleet management roles in aviation and public transportation. It also involved studying real-world use cases for SAM where the insertion of human agency into an automated loop is likely to be vital, now and in the future. This year we have moved from research to the design phase, taking a leadership role in the creation of experimental systems for effective collaboration between humans and autonomy. We are currently collaborating on building a prototype of a front-end teaming interface and back-end teaming manager for SAM.

Our work on this experimental prototype has been influenced and aided by a collaboration we established with a team of Human Systems Integration researchers at NASA’s Ames Research Center who study the future role of automation in national airspace management. They have been working on validating a HAT paradigm that seeks to find a ‘sweet spot’ between too much human labor and too much brittle and alienating automation.

Their approach to interface and system design emphasizes a few key principles which we will explore further in the next section: 1) careful provision of information to support full situational awareness for the operator 2) transparency to allow the operator to understand of what automation is doing and how they can affect its actions; 3) bi-directional communication to allow human and AI to work collaboratively to generate and evaluate options and make decisions; 4) variable levels of automation (LOAs) that put neither human nor automation exclusively in charge of most tasks; and 5) a “playbook” concept that brings it all together, wherein collaborative action is enacted quickly by predefined scenarios at variable LOAs with set goals, roles, and responsibilities, and that the human and the autonomy settle-on collaboratively in response to different real-world scenarios they face (Brandt et al. 2017).

By experimenting with these principles in our work, we aim to make Mobility Management not only efficient and safe, but also ethical and engaging, as we incorporate new capabilities our engineers are developing for our AI ‘teammates’, such as robot introspection and self-explanation. As practitioners in industry we must remain focused on efficiency and functional fleet management foremost. Yet teaming’s feel-good ethos of ‘bringing out the best in everyone,’ and its promise of flexibility in designing interactional relationships, leaves room to stretch out into implications for ethical and political domains—especially since design prescriptions such as “transparency,” as we will see, operate deeply on both the functional and ethical levels. This has left us room to more quietly address issues brought up in the work of anthropologists of technological labor (Gray and Suri 2019; Elish 2019), especially the ethical consequences of calibrating agency.

## DISCUSSION: HUMAN-AUTONOMY TEAMING IN ACTION

The HAT prototype we are currently designing began with the management of human involvement in just one type of on-road use case: the ‘obstructions’ case described briefly in the introduction. Obstructions are an early and paradigmatic case for the use of a human-in-the-loop in AV systems, and elaborating them here provides a good example of the contest over human role and function and the kind of ‘cut’ that HAT takes at the question. It exposes connections between how “micro-interactions” between AI and operators are implemented, and ethical and “macro-” consequences for three domains: worker alienation; growing economic inequality; and worker culpability for accidents.

Obstructions cases are usually easy situations for human drivers to handle, so easy we do them without conscious thought. You see a delivery truck parked in your driving lane with its flashers on, and quickly you do a number of things: determine if it is legitimate to try to overtake it; determine if it is safe to overtake it, even though you have to cross momentarily into the other traffic lane; and initiate a way to overtake it.

But obstructions are actually quite difficult for autonomous systems to handle on their own today, for reasons that are being actively researched and debated. Each of these reasons might be understood as a potential opportunity for teamwork and a “role” for the Mobility Manager: as “social-knower;” “technical band-aid;” AI “machine trainer;” and “legal actor” as described below. These positions are not mutually exclusive. And each of these positions has had, at different moments, different supporters among key technologists and decision makers in the lab, who grapple over which parts and capabilities of the human operator to make use of in order to divergent technological and business goals.

We as UX researchers, at least ideally, represent the interests of the human— rather than technological, business or other kinds of interests—in the design process. Looking at this internal debate among stakeholders about the human’s role in the system, it becomes pertinent to ask: “What is in the interest of the human being with respect to these types of potential roles within complex, multi-agent systems?”

### Contending Work Roles

#### *Human as “Technical Band-Aid”*

*“[The] vehicle can tell the traffic state, and even recognize some hand gestures, but human judgment is required for the appropriate course ... The request is routed to the mobility manager, who decides on the correct action, and creates a safe path around the obstruction” (Nissan 2017a)*

The earliest technical capacity given to the human in SAM was *teleoperation*: the ability to direct an AV along a human-drawn path forward, not by remotely driving (or “joysticking”) the car, but by sending it instructions (speed and directionality).<sup>1</sup> This capacity was useful for situations where the AV’s ability to plan its own path was comprised, and was built upon NASA technology used to direct robots around the surface of Mars. Thus the first concept of a role for the human-in-the-loop made her into a technical band-aid, an agent that would make up for technical deficiencies with respect to *how* to go around an Obstruction. Teleoperations takes some risk out of the job of mobility management, as the AV always decides for itself *when* to go or stop and keeps its basic sensors and crash-avoidance

functions engaged. But this role does imply a human making up for technological lacks such as visibilities and insufficient maps, in an effort to streamline the development process and make possible early introduction of AVs.

#### *Human as “Social Knower”*

*“How are you gonna know if you can go around? What’s this guy waving trying to tell you to do? We will need a human to understand the situation and make that call.”*

– An employee in the laboratory, talking about SAM

Studying on-road Obstructions use cases, however, it was soon realized that the question of *if* an AV should go around an obstacle might be the bigger problem than figuring out *how* to go around one—especially as the technology improves and the need for technical band-aids decreases. Indeed, in more recent implementations of the Obstructions use case, the autonomy proposes its own path around the obstacle for most situations, and the human’s role is simply to confirm or deny the social legitimacy of the maneuver.

The social knower vision is all about context. Understanding context in human terms and engaging fluently in the social domain have been longtime problems for automated systems. Treating the human mobility manager as a “social knower” is sometimes a pragmatic response to current difficulties, but it can also represent a broader philosophical position about the limits of AI, and the indelible place for the human in knowing specifically “social” or “human” things like the context of the situation (Is this really a passable object? Is that a cop directing me to go around, or just a person waving?). In this imagination, the human mobility manager is a contextual interpreter, a common-sense reasoner, and an indelible aspect of a successful system. Some managers at the lab have championed this role as the *raison d’être* of the Mobility Manager position.

#### *Human as “Machine Trainer”*

*“The system learns and shares the new information created by the Mobility Manager. Once the solution is found, it’s sent to the other vehicles. As the system learns from experience, and autonomous technology improves, vehicles will require less assistance and each mobility manager will be able to guide a large number of vehicles simultaneously.”* (Nissan 2017b)

As the SAM system has further evolved, more attention has been given to how the system will improve over time. We do not want to just solve the case at hand, but get better at solving other similar cases. In this vision, the mobility manager is an annotator who is creating the data set that will allow a future AI to succeed where current AI has failed: labeling misrecognized objects in a scene, or modeling “good driving behavior” so that it can be copied. This vision is about machine learning. Spurred by advances in supervised machine learning via neural networks, there is great hope that, with enough labeled data, a clever architecture can solve any problem. But data *is* the problem. In a space as complex as that of the roadway—even just for obstacle avoidance scenarios—the number of examples needed might exceed tens of millions. In this view of the human’s role, there are no philosophical reservations about unique human capabilities; she is just there to produce the necessary data.

Over time, her role becomes less and less necessary until perhaps she could be eliminated entirely by AI trained upon her own labor.

#### *Human as “Legal Actor”*

*“What is the system going to do when it has to break rules? Are you going to allow it break rules? But how are you going to define what rule it can break when and how?”*

– The Lab’s Chief Technical Director, quoted in an interview (Margeit 2019)

This vision is about responsibility. Anyone who goes through driver training in the United States—and many people who get ticketed by law enforcement—can recognize the extent to which the legal rules and social norms of the roadway come into conflict. It is generally illegal, for example, to cross a double-yellow line in the US. It is also illegal to double-park one’s vehicle in a travel lane. And the California Vehicle Code makes no exception to the line-crossing rule in this case. But if AVs cannot break the law sometimes to overtake illegally stopped vehicles, they will be largely incompatible with existing streets and human behaviors, something legal experts themselves have been recognizing (Law Commission 2018). In conflicts between multiple laws, or between laws and norms, this position on the mobility manager’s role suggests that they will certify these normal, tacitly legal maneuvers such as permitting a vehicle to cross over a double yellow line to avoid an obstacle, when it is safe to do so. But, unfortunately, this kind of mobility manager could also be a scapegoat for the vehicle operator to offload responsibility in the event of an accident or citation from law enforcement.

### **The Social Costs of Work Roles**

Role is helpful because it identifies where the AI is ‘weak’ and where humans are ‘strong,’ and therefore highlights use cases and reasons for including humans as teammates. Yet we have come to believe via our research on SAM and study of HAT that focusing on role alone is actually the wrong frame if we want to understand the ethical consequences of human-automation relationships. When evaluating work roles in light of ethical concerns, in other words, it may matter less *what* the Mobility Manager does—that is, their role as social knower or legal actor—and indeed they will likely occupy multiple of these roles at different times as they solve problems. Rather, what emerges as of more concern is the *how* of that function—the implementation of the interaction design, which may or may not have a direct relationship to imagined role.

In other words, what must be considered is the *automation paradigm* (Endsley 2017): the high-level model of how the human and automation will interact, how responsibilities will be allocated between them, and how these allocations will change in the course of operation. There are, as we will see, multiple ways that a social knower role, for example, might be implemented, from paradigms that literally take the conscious decision-making out of the process, to ones that put the human into a (troubled) supervisor position with respect to the autonomy. Each of these positions could be made part of a human-autonomy team picture, but each has often been envisioned in the Lab outside of the team frame, instead in ones that reproduce master-slave dynamics, such as microwork, supervisory control, and

engineering paradigms. Each automation paradigm raises technical issues and presents political and ethical consequences for the worker.

### *Worker Alienation*

In order to illustrate an extreme case of what it might mean to produce the Mobility Manager within SAM as an alienated laborer, we turn to a series of discussions we were involved in during early 2019. A novel paradigm was proposed with a novel technology attached: brain-machine interfaces that can interpret pre-cognitive signals from human brains. The brain-machine interface—a helmet with sensors for brain activity—was imagined as a partial solution to the Obstructions use case, in that its wearer could generate quick “go or no-go” decisions when the time was right for a supervised AV to overtake an obstacle on the road. Such a scheme puts the human in the social knower role, but as a pre-cognitive “social reactor” responding based on instinct to live video of the scene.

This is an automation paradigm best described as *microwork* (Lehdonvirta 2016). Microwork, or micro-tasking, is an increasingly common automation paradigm that forms the basis of so-called “flexible work platforms” like Amazon’s Mechanical Turk and Facebook’s Content Moderator work regimes. Microwork is considered the smallest unit of work in a virtual assembly line, describing tasks for which no efficient algorithm has *yet* been devised, and that today require human intelligence to complete reliably (Irani 2015). Tasks like supervising an autonomous vehicle around an obstacle can be further chopped into these ‘micro’ subtasks, including image identification, transcription and annotation; content moderation; data collection and processing; audio and video transcription; and translation. The very Tayloristic idea here is that the proper way to insert human agency into the loop of AI is to define precisely the tiny inputs an operator will contribute to process.

Microtasks tend to be repetitive, menial and tedious—the kind of job it is easy to create, but not necessarily the kind of job that the creators would want for themselves. Microwork-intensive automation paradigms have the potential to alienate the worker from the experiences that, research shows, make work satisfying: doing a variety of kinds of tasks, using higher order processing and troubleshooting skills, managing situations, communicating with others, helping people, using creativity, learning and growing, and making independent decisions (Manyika et al. 2017). These are the kinds of things that, taken together, produce a profession or a craft rather than a menial job, and that give us the opportunity to connect and use our human capacities.

Like Marx, we are concerned with the degree to which a job allows one to express fundamental parts of one’s humanity, or whether it suppresses those human aspects for the goal of efficiency or some other value. Marx wrote of alienation in these terms:

It is true that labour produces marvels for the rich, but it produces privation for the worker. It produces palaces, but hovels for the worker. It procures beauty, but deformity for the worker. It replaces labour by machines, but it casts some of the workers back into barbarous forms of labour and turns others into machines. It produces intelligence, but it produces idiocy and cretinism for the worker. (Marx 1844)

While Marx was describing the conditions of workers in the 19<sup>th</sup> Century, such lines could just as easily describe a ‘brain helmet job’ working amid a 21<sup>st</sup> century, mostly-

autonomous technology. The political and ethical questions with microwork today are much the same as with assembly-line work, leading Horton (2011) in *Economics Letters*, referencing Marx's co-author Engels, to inquire into what he cleverly calls the "Condition of the Turking Class." The vision here is of workers doing the same tiny task over and over and over again, the value of the human whittled down to just one tiny capability. "Go, go, no go, go, no go"—read off brain signals.

Any of the above roles can ostensibly be turned into a microwork job—all it requires is the extreme limitation through interface and work design of the scope and variety of the human's agential contribution. Teaming, taken seriously, rules out microwork as a desirable human-machine future, and therefore presents a possible (if only inadvertent) wedge to the plight of the Turking Class. This is due, in particular, to its organizing concern with the perils of over-automation and brittleness, and the resulting emphasis on ensuring both situational awareness and meaningful decision-making on the part of the human actor. Particularly important for HAT is minimizing "confirmation bias," or the tendency of humans within highly automated decision-making systems to agree without really *thinking* with the AI's reading of situation and its plans (Endsley 2017).

From a HAT point of view, if the problem with machines is that they are brittle—unable to respond appropriately when the situational context in which they are acting shifts—then an enduring task for humans on teams is likely to be in helping the machines react dynamically to *novel* situations. And this means that rather than inputting the same datum the same way over and over, part of the human operator's job description should be to make holistic situational assessments, at least in some cases, and to have a latitude for creative response. Doing so requires providing the operator with full situational awareness—something that microwork and chunking deliberately deny. In the best HAT arrangements, a remote operator achieves situational awareness of the external environment *and* of the automation itself at the highest level: they know what is going on, what that means, and what may happen next, for both the internals of the system and the real-world outside (ibid).

A second area where HAT might intrinsically help is that, due to its emphasis on variable levels of automation, it might produce more variety on the job. An operator can 'call' plays at the highest level and dynamically adjust Levels of Automation for tasks and subtasks within a play based on contextual factors. For instance, if the operator is being overloaded by too many issues, they can potentially: allow the automation to take full control of the least critical cases; check AI's suggestions for medium-risk cases; and be themselves totally in charge of handling particularly tricky or ambiguous situations. This ensures that while routine matters might be highly automated, humans are invited to use higher-order skills like critical thinking and creative social communication when the situation warrants.

### *Worker Inequality*

Not coincidentally, the same kinds of skills and capabilities that produce greater worker satisfaction in their exercise—empathy and social communication, critical thinking, problem understanding and response—are precisely those being identified as the last vestiges of the human with respect to automation (Manyika et al. 2017). These higher-order, complex, integrative and deeply human skills—unlike, say, picture annotating or other micro-tasking jobs which are *designed* to be automated as soon as possible—are more likely to be safe from automation far into the future.

This observation directly connects our first concern with alienation to our second concern with economic inequality. The ‘Condition of the Turing Class’ (Horton 2011) is not simply an experiential problem that describes a particular kind of mindless, repetitive labor. It is also an economic problem, since these kinds of jobs tend to pay very poorly, and are literally just about to be automated. A recent International Labor Organization survey of working conditions covering 3,500 workers living in 75 countries around the world, and working on five English-speaking microtask platforms, found that on average a worker in 2017 earned US\$4.43 per hour when only paid work was considered, and US\$3.31 per hour when total paid and unpaid hours were considered (Berg et al. 2018). Median earnings were lower, at just US\$2.16 per hour when paid and unpaid work were considered.

Conversely, job security from automation is increasingly pegged not just to jobs that are more cognitively difficult, but also jobs where there is variety and integrated functioning. Indeed, since 1980 employment and wage growth has been strongest in jobs that require high levels of both cognitive skill and social skill—again, the variety that makes jobs satisfying, expressing more human skill and, in combination, seeing a greater reward in the marketplace (Deming 2017). The 2019 report of MIT’s Work of the Future Task Force echoes these findings, suggesting that policymakers focus on job *quality* rather than job quantity alone, and arguing that countries should concentrate their investments on delivering “middle-skill jobs with favorable earnings and employment security to the vast majority of their workers” (Autor et al. 2019, 17-19).

There is a social cost to making too many jobs that are too elite. In their book the *Second Machine Age*, Brynjolfsson and McAfee (2014) argue that the growth of inequality today can be directly tied to the growth of the tech economy. And just as much as the elimination of routine jobs via automation, the biggest factor in the growing chasm, they argue, is overvaluation of the technology makers: the small elite that innovate and create. The technology-driven economy “favors a small group of successful individuals by amplifying their talent and luck, and dramatically increasing their rewards,” (Rotman 2014). We see the results of this in tech-driven economies like Silicon Valley where we work, and where salaries of the class of technical creators are notoriously high and competition for labor is tight, but where other laborers struggle to get by.

The focus on achieving balance between too much and too little autonomy in HAT points us toward the middle: not producing dead-end jobs, but also taking care not to make every human-in-the-loop job into an *engineering* position. If not integrated into other, more lasting tasks in the design of work role, turning the mobility manager exclusively into the role of machine trainer can lead to the problem of temporary, dead-end labor. Conversely, making the human into the role of “technical band-aid” has the potential to peek ever closer to remote engineering. This position implies a relationship to the machine of creation, design, maintenance, or repair, and requires years of specialized training and experience that are out of reach for everyday laborers.

### *Worker Culpability*

Finally there is the issue of liability and blame when something (inevitably) goes wrong. This issue is obviously more serious for safety-critical operations like mobility systems that transport human bodies at high speeds. Self-driving cars are likely to be one of the first intelligent and semiautonomous technologies to be widely adopted in safety-critical



environments. We have yet to see all the ways in which liability will, or will not, be distributed, but we already know that it will be contentious. Culpability is an obvious problem in a legal actor role, but could be an issue in any role for something like an obstructions use case, where operator agency is inserted into decision-making loops that involve live, on-road AV operations. Here again the HAT focus on situational awareness, as well as on transparency and bi-directional teaming, might help.

In a recent paper in *Data & Society*, Elish (2019) describes that intelligent and autonomous systems in every form have the potential to generate “moral crumple zones.” A “moral crumple zone” describes how responsibility for an automation error may be incorrectly displaced onto a human actor within the system who in fact had very little control over the erroneous behavior:

“Just as the crumple zone in a car is designed to absorb the force of impact in a crash, the human in a highly complex and automated system may become the component—accidentally or intentionally—that bears the brunt of the moral and legal responsibilities when the overall system malfunctions. While the crumple zone in a car is meant to protect the human driver, the moral crumple zone protects the integrity of the technological system at the expense of the nearest human operator.” (Elish 2019, 40)

The concept of the moral crumple zone ties together the structural and functional features of a system: that is, the complex and unclear distribution of control among multiple actors across space and time, and the popular media’s human-centered portrayal of accidents. It explains how human operators come to be primary seats of public accountability in human-machine systems. Moral crumple zones, according to Elish, are likely to take shape in the immediate aftermath of a highly publicized event or accident. And they are also more likely to take place when there are certain disjunctions in the automation paradigm: when there is a mismatch between the capacity of the human-in-the-loop to know about the state of a situation, and the human’s authority and capacity to act on that situation.

There are infinite permutations of this disjuncture between acting efficaciously and achieving situational awareness—that is, knowing comprehensively and correctly what is happening and what it means for the future of the system (Endsley 1995). They have played a part in headlining disasters where humans have been dragged through the mud in the media aftermath, including the classic case of the nuclear meltdown at Three Mile Island, as well as the more recent 2018 crash involving an Uber AV in Tempe, AZ, in which a pedestrian was killed. In the latter case, the ‘self-driving’ car was a modified Volvo XC90 SUV equipped with many driver assistance features, but running Uber’s own self-driving software which had (for unclear reasons) disabled those features (NTSB 2018). Had these systems not been disabled, it is expected that the Volvo would have engaged the brakes and stopped before hitting the pedestrian. Yet the report and subsequent media coverage focused on the safety driver’s behavior, with concerns raised as to whether she was looking at her cell phone or streaming media (Somerville & Shepardson 2018). In other words, despite a complex set of factors precipitating the crash, public scrutiny focused on the driver, who may now be facing criminal charges (Elish 2019).

Both safety drivers in autonomous test vehicles and managers at nuclear reactors share a position with respect to automated systems known as “supervisory control.” In this paradigm, the autonomous capabilities of the system operate effectively on their own most

of the time, but the system is designed to “hand off” control to the human in the most difficult situations (Sheridan 1992). This might happen when the system recognizes its own fallibility in relation to a difficult situation—such as a nuclear reactor alerting control room operators that something is amiss—or when the human is charged with recognizing an impending issue and ‘overriding’ the automatic functioning of a system on their own—as is expected of safety drivers in AV systems.

In both cases operators are expected to be alert and monitoring the system, despite few technological affordances supporting the maintenance of that level of mental engagement. The problem with supervisory control, then, relates to one of the “ironies of automation” (Bainbridge 1983) or what Endsley (2017) has called the “automation paradox”: as more autonomy is added to a system, and as its reliability and robustness increase, the situational awareness of human operators becomes lower, and it is less likely that they will be able to take over manual control when needed. If the operator is superfluous much of the time, just sitting there watching, this makes it *essentially impossible* to maintain situational awareness. Yet as the “supervisor,” the human is in position to be immediately made responsible if they don’t ‘snap to’ and handle those dangerous edge cases appropriately, or proactively detect problems in the automation.

Ultimately, protecting the operator from blame in failure situations will require much more than having the right automation paradigm in place. There must, at minimum, be a policy that accidents are never the human’s fault outside of a short list of absolutely essential job requirements, and within the context of specific and known protocols for what the human responsibility is. But given that our intervention in this paper is at the level of the automation paradigm, we can add the requirement that the operator be presented with data consistent with the achievement of situational awareness, and that the work be designed such that their ‘human factors’ are respected enough to keep them engaged to a degree commensurate with their moral and legal responsibility.<sup>2</sup> In other words, what is most important is not that the human have “more” agency in situation so they can “take the wheel” when needed. Rather, what matters in work design for highly automated systems is that there is congruence between awareness and responsibility, and enough transparency for the operator to understand what the automation is doing and what she can do to affect it.

## **HAT: A MORE ETHICAL AUTOMATION PARADIGM?**

Taking these three issues—alienation, inequality, and culpability—together, we get a picture of a position that we would like to design that can be described in terms of a few organizing values. This is a position characterized by variety of tasks, continuous engagement in knowledge-gathering and decision-making, and congruence between awareness and responsibility. Rather than focusing on making the Mobility Manager a social-knower, legal entity, or machine trainer, the best outcome for the worker might be to have them engage in all of these different roles at different moments in a work flow, and to play these roles at different levels of automation *vis-à-vis* the machine, and in different ways. Variety, in particular, would seem to emerge as a clear winning value: it makes the job less liable to be automated in the future, and thus potentially higher skilled and more humane; and it might also engage the worker more, keeping her cognizant of her level of responsibility and perhaps more interested in the task.

Our argument is that there is a potential congruence between HAT principles for creating operational effectiveness through an intermediate-automation approach—where an operator is working on a variety of kinds of situations, and at a variety of levels of automation, while maintaining situational awareness—and worker well-being on the job in a more wholistic sense. Although it is in its relative infancy as an automation paradigm, HAT seems to be a more humane and plausible vision than other automation paradigms being pursued, within and without our organization. By operating under the rubric of Teaming, we have been able to make technical and safety arguments for certain relations to the machine that we consider potentially more ethical, and which might result in a job that is engaging, at a medium skill level, and that could protect the operator from mismatch between what they know and what they are capable of doing (and from resultant blame for accidents).

Obviously none of this can guarantee a “good job,” nor can it shield the operator from blame if something goes wrong absent larger institutional and social protections. Further, HAT is minimally-developed on a technical level, and requires continued research and testing. But our hope is that in continuing to use this paradigm to experiment with the calibration of human agency in effective coordination with AI in our SAM system, in a terrain where the *what* and *how* of the human being’s involvement is so up in the air, we can push for a more progressive worker agenda. We are finding in the “team” an ability to focus on technical performance while maintaining (sometimes covert) attention to human well-being.

In our business, the argument must be made that retaining human dignity will make workers more productive in creating business value, or that efficient management of highly automated systems is simply impossible without agential, empowered humans in the loop.<sup>3</sup> Rather than forwarding purely ethical arguments for the higher-order functioning, diversity of tasks, and other desirables that we think are consistent with better overall outcomes for workers, Teaming has provided us with a technical and theoretical basis to argue these are necessary to system operations. Luckily, through collaborations with the open-minded engineers, designers and project managers with whom we have the privilege of working on Mobility Management, this Teaming vision seems to be winning for now over other contending automation paradigms at our lab.

**Laura Cesafsky** is a UX Researcher at the Alliance Innovation Laboratory in Silicon Valley. Their work focuses on shaping the user experience of workers, customers and publics as they interact with AI-intensive vehicle systems.

**Erik Stayton** is a PhD candidate in the Program in History, Anthropology, and Science, Technology and Society at MIT. He investigates human interactions with AI systems, and currently studies the values implicated in the design, regulation, and use of automated vehicle systems. He has been an intern at the Alliance Innovation Laboratory.

**Melissa Cefkin** is Principal Researcher and Senior Manager of the User Experience group at the Alliance Innovation Laboratory in Silicon Valley. She has had a long career as an anthropologist in industry, including time at the Institute for Research on Learning, Sapient, and IBM Research.

## NOTES

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1. The Seamless Autonomous Mobility system was first publicly demonstrated at the Consumer Electronics Show in 2017. Videos and press images of the system are available online.
2. Designing for operator engagement—up to and including feeding unnecessary or non-critical tasks to keep the operator aware—is an important part of Joint Cognitive Systems Design, and is used in airline contexts to maintain pilot situational awareness (Woods and Hollnagel 2006).
3. For more on this topic, see our previous EPIC paper focused specifically on what benefits beyond operational capabilities alone that empowered human beings can bring to a system (Stayton and Cefkin 2018).

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## PechaKucha and Papers Session

### Negotiating Agency

Curators: Bridget Monahan (Google) & Abbas Jaffer (Facebook)

The throughline that ties this session together are the opportunities and limits of representing our own and other people's agency in method and practice. The papers in this session discuss how people exercise agency by negotiating differential ability and technological change, either in their professional or personal everyday lives. The PKs share how negotiation over agency hinges on recognizing and allowing for the expression of actual human needs. Making space for, taking into account and welcoming all kinds of human experience in its messy authenticity.

Greg Weinstein discusses a form of "participatory phonography" he developed to help understand the experience of blind Uber users through sound. Weinstein's paper shares their grounding in participatory research and the iterative process they went through to best represent sonic experience to stakeholders. In Tamara Moellenberg's paper, we learn about reckonings with the automation of work in insurance, pharmaceutical, medical and telecommunications industries. Moellenberg and colleagues at ReD discovered that among many strategies were professionals changing their customer, their ways of work and intensifying a focus on the value of the human in a context of increasing automation.

The Pecha Kuchas in this session all bump up against hard boundaries of agency. In Tabitha Steager's PK about learning to love data, we see a negotiation between the desire to motivate change by telling real people's stories and the reality of policy-making that demands overwhelming numbers. Ruben Perez Huidobro's PK explores the restrictions of personal and professional agency in an environment which mandates conformity. In his research, Perez Huidobro traces a form whose check boxes and text lines stand in for a person's actual movement throughout a prison. And Chelsea Mauldin's PK muses on the inability of design & research to solve for the social problems "we" want to address because "our" work ultimately abstracts and adds complexity to the very problems we are trying to solve for people.



## Change Agent

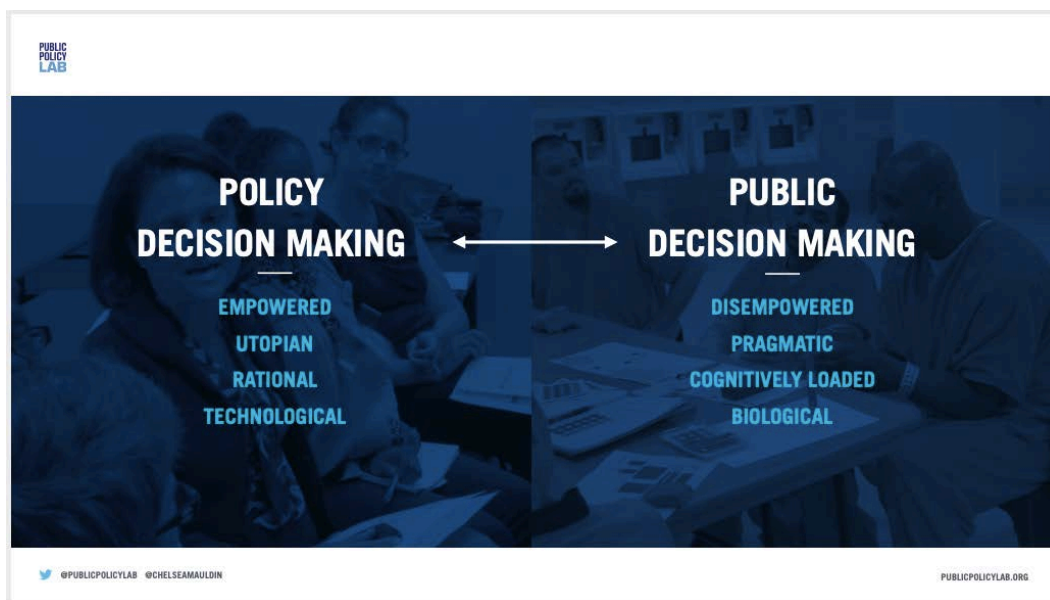
### Lessons on Power and Failure from Eight Years of Systems Research & Policy Design

CHELSEA MAULDIN, *Public Policy Lab*

*Drawing on nearly a decade of research and design engagements with U.S. federal and municipal governments, I'll describe a gap between intended outcomes of government policies and the lived experience of people affected by those policies. I'll discuss how that gap arises from variances in the decision-making agency of policymakers and members of the public.*

*Next, I'll discuss how human-centered researchers and designers attempt to equalize government/public agency through interventions in the policy decision-making cycle. Then I'll suggest criticisms and shortfalls of current human-centered approaches to improving policy and service-delivery systems, including researchers and designers' tendencies to amplify complexity, to extract value from the public, and to accept status quo inequality.*

*Finally I'll propose that, when using research and design as tools for positive policy and systems change and increased agency for marginalized peoples, we must: seek to design new, adjacent policy systems, rather than to continue to renovate broken policies; recognize the primacy and requirements of the human body, as mechanism through which people engage with and are effected by policy systems; and more consciously identify and address imbalances in agency and power in the systems in which we intercede.*



"The Decision-Making Gap," © Public Policy Lab

**Chelsea Mauldin** is a social scientist and designer with a focus on government innovation. She directs the Public Policy Lab, a New York City nonprofit organization that designs better public policy and services for low-income and at-risk Americans. Find out more on PPL's website, [www.publicpolicylab.org](http://www.publicpolicylab.org), or on Twitter at [@publicpolicylab](https://twitter.com/publicpolicylab). Previously,

Chelsea consulted to municipal and federal agencies, directed a community-development organization, and led government partnerships at a public-space advocacy nonprofit. She is a graduate of the University of California at Berkeley and the London School of Economics.

## Data Walks into a Bar

### A Love Story

TABITHA STEAGER, *Workday*

*As a qualitative researcher, I was always a bit afraid — if not disdainful — of quantitative data. This pecha kucha tells the uneasy love story of how and why I fell in love with quantitative data. Transitioning from life as an ethnographer who avoided quantitative work at any cost, I found myself working as an applied researcher using a method that relied heavily on large amounts of quantitative data. I had to learn how to tell a story using a data format with which I was relatively unfamiliar. I was also doubtful about quantitative data and that it was often privileged over qualitative work and angry at the power it sometimes held over people's lives. However, as I began to get closer to it, I realized that I was ascribing quantitative data an agency of its own, an agency it definitely doesn't have. I moved through my doubt and ultimately came to fall deeply in love with the sweet spot that exists when we can marry qualitative and quantitative data to give voice to those whose agency has sometimes been stripped from them through the use of quantitative data and instead use it to help tell a more insightful and complete story.*

**Tabitha Steager** is an anthropologist and UX researcher with special interest in place and community, food, visual ways of knowing, and Indigenous rights. She received her PhD in Interdisciplinary Studies (anthropology and human geography) from the University of British Columbia. She has conducted research in Canada, the United States, Mexico, England, France, Italy, and with First Nations across British Columbia. She currently leads the UX Research practice for Workday Analytics products.

## Adapting to the Lack of Agency Research in Prisons

RUBEN PEREZ HUIDOBRO, *Shopify*

*How can a researcher adapt to the lack of agency in secure environments?*

*HM Inspectorate of Prisons in the UK published in 2012 a thematic report about the use of the “person escort record” (PER) with detainees at risk of self-harm, highlighting the high number of deaths in custody. The PER was used during the transport of people under custody, and informed about their security and safety issues.*

*As a result of this report, my team had the mandate to improve how security and safety risks were communicated. I needed to identify the needs and pain points of the people working on prison and court services, and I did so throughout multiple contextual research sessions.*

*Due to the lack of agency in secured environments, I had the constant need to adapt and identify opportunities to bring to the team the information they needed.*



Photo by Matthew Ansley on Unsplash

**Ruben Perez Huidobro** is a Senior User Experience Researcher at Shopify. He has over a decade of experience in the UX field. He has lived and worked in Spain, United Kingdom and Canada. Before moving to Toronto, he worked as a User Researcher for the UK, Government Digital Service (GDS) and the UK, Ministry of Justice (MoJ) among others. He has also worked in international research projects across Europe and Latin America.

## Hearing Through Their Ears

### Developing Inclusive Research Methods to Co-Create with Blind Participants

GREGORY WEINSTEIN

*This paper recounts research into the orientation and mobility experiences of people who are blind or visually impaired, and describes the novel sonic research method I developed for this purpose. “Participant Phonography,” as I call the method, aims to empower research participants with low or no vision through the self-guided creation of sound recordings that represent their experiences of the world in a first-person perspective. More broadly, the paper highlights the inadequate efforts of ethnographers in industry to tackle challenges of disability and reflects on the ethical challenges that face researchers who want to include disabled people in research. Inclusive methods like participant phonography have great potential to break down traditional power structures that have rendered non-normative groups marginal in user research, but these methods also come with substantial barriers to their implementation in a corporate context.*

I begin to hear the old sounds as though they are not worn out. Obviously, they are not worn out. They are just as audible as the new sounds. Thinking had worn them out. And if one stops thinking about them, suddenly they are fresh and new.

—John Cage

#### Julie

*It is late on a Monday afternoon and I am making my way up Market Street in San Francisco. I am holding a digital recorder and walking alongside a woman I’ll call Julie. Julie is holding a shotgun microphone in one hand, which is connected to my recorder, and in her other hand she grips the harness for her guide dog. I offered Julie the option of taking more control of the recording equipment, but she pointed out the obvious: since she needs one hand for her guide dog, it was probably safer if she only held one microphone in the other hand.*

*We’ve been on the move for about 20 minutes. Eventually, we cross 4<sup>th</sup> Street and stop near the entrance to the BART station. “That’s too bad,” Julie says. “There are usually drummers playing on this corner, and I thought that would’ve been interesting to get on the recording.” Julie makes recording on her own sometimes, but today she is trying to give me some insight into the role that sound plays in her everyday life. Because she has no sight, Julie relies heavily on sound to make her way around the city, to stay safe in heavily trafficked areas like downtown San Francisco, and to interact with people both in person and digitally.*

*We are recording entirely for my benefit. Julie has already told me quite a bit about the value of sound to her daily routines—basic things like detecting the direction of traffic when you want to cross the street, and more advanced ideas about the subtleties of navigating obstacles by herself and with her guide dog—but I am hoping to capture, with her help, some trace of her subjective sonic experience to help me understand the difficulties that blind people face every day when they commute, take the bus, or walk on the sidewalk.<sup>1</sup>*

## INTRODUCTION: HEARING THROUGH THEIR EARS

There is a well-known cliché about “seeing something through someone else’s eyes.” The saying is about the power of empathy: when you can see through another’s eyes, you can understand their experiences of the world, their motivations, and their actions. The saying relies on a *visual* metaphor: empathy comes from *seeing* through another person’s eyes. Such linguistic artifacts subtly occlude the reality that sight is not the only sense through which we experience the world, and for many people, is not even the primary sense. If we see through someone else’s eyes, is it also possible to *hear* through someone else’s ears? Can we develop empathy through someone else’s sonic experiences, and use that empathy to motivate design choices?

This paper proposes to do just that. The research I describe was conducted at Uber with the goal of understanding the transportation experiences of people who are blind or visually impaired.<sup>2</sup> I wanted to develop a holistic understanding of how blind and visually impaired people travel and navigate, and to do this, my insights would need to be largely sonic. Visual information is, at best, a very small part of how someone who is blind or visually impaired understands the world. Therefore, I developed a sonic ethnographic method that would allow me to understand how participants use sound to navigate a world whose design often assumes that users are sighted.

I argue that we need new methods to research the experiences of people with diverse abilities, and that these methods are hardest to implement in a corporate setting where business concerns are sometimes at odds with the ethics of good ethnography. Further, researching the experiences of disabled people is politically fraught, since historically this sort of research has granted no agency or ownership to the people at the center of the research. More recently, disability researchers have worked to create more inclusive methods and to empower disabled people through research. Researching inclusively is essential to creating inclusive services and products, and I attempted to make my own acoustic anthropological method as participatory as possible—albeit with only qualified success, as I discuss near the end of this paper. In the end, I propose that we must develop inclusive research methods in all sorts of ethnographic work if we wish to design a world that is itself truly inclusive.

## INCLUSIVE DESIGN...

There is a clear moral imperative for companies to provide services and products that do not exclude people by the nature of their design. And it is equally clear that a great number of companies struggle to meet this usability standard (if they even try at all). The world abounds with examples of products that cannot be used by disabled people. Sometimes these are the result of ignorance or neglect, and sometimes companies make strategic business decisions not to design for people that they consider to be on the margins of their customer base. There is a perception that designing for people with disabilities is too costly and cannot be justified by revenue generated by such designs.

Such thinking is short-sighted, and it means that people with cognitive and physical impairments are often discriminated against, if not outright prohibited from consuming and participating in equivalent ways to non-disabled counterparts. Which brings me to the core tenet of this paper: Inclusive design requires inclusive research.

Before discussing the concept of inclusive design, however, I must briefly unpack the term “disability.” The social model of disability distinguishes between “impairment” (which refers to the individual) and “disability” (which is a structural problem). For instance, not being able to see is an individual impairment, but it becomes a disability when we consider all the ways in which the world is not designed for the experiences of people who are blind. In the social model, the term disability itself comes to represent a condition of oppression, wherein people with impairments are excluded from participating fully in society by the design of the world around them. “The social model [of disability] is a deliberate attempt to shift attention away from the functional limitations of individuals with impairments onto the problems caused by disabling environments, barriers and cultures” (Barnes 2012: 18). Because disability is a problem of the world not being designed to be used by people with impairments, its solution must be a design solution: how can we create a world that is inclusive in its design so that people are not excluded from participating in it?

By “inclusive design” I mean what is (in the United States) generally referred to as “universal design.” When we think in terms of inclusive or universal design, the financial case against designing for the needs of disabled users simply falls away. Inclusive design, as the name suggests, strives to include as many people as possible in the use of the product or service in question without needing to modify the product. The antithesis of “accessible” design, inclusive design does not mean designing a product meant to be accessible to a small number of people with disabilities, but rather, that by considering the use cases of people with a variety of abilities, one can design for an extremely broad and diverse user base. According to Steinfeld and Maisel, thinking only in terms of “accessibility” leads designers to believe that there is only a small “niche market” in serving people with disabilities (2012: 68). However, that is only true if one thinks of products that serve disabled people as being completely separate from a company’s “normal” products. Good inclusive designs are easier and friendlier for *all* users, and thus, are precisely the opposite of a niche.

The classic example of an inclusive design is the “curb cut,” the gentle ramp in sidewalks that make it easier to cross the street. Popularized as a way for World War II veterans in wheelchairs to get around, curb cuts have proven useful for a huge number of users: people pushing children in prams, people pulling luggage, workers wheeling heavy equipment from a truck into a building, and people on roller skates, to name only a handful. From the 1960s, curb cuts began to be joined with another innovation: the truncated dome. Often in high-visibility yellow, truncated domes are a patch of low bumps that alert blind and visually-impaired people to the end of the curb and the beginning of the street. And again, these provide valuable warnings for many people, not only those with visual impairments.

By finding “curb cut” solutions to design problems—by creating inclusive designs that address a wide range of people’s abilities and use cases—companies can actually increase their customer base because they have included even more potential users in their designs. Ensuring that disabled users can use a product or service is hardly an unprofitable niche. It makes good business sense, and it is the only ethical way to address users’ needs inclusively.

### **...REQUIRES INCLUSIVE RESEARCH**

Intuitively, it might seem obvious that we need inclusive research in order to create inclusive designs. One cannot design for a broad, inclusive group of users without understanding the variety of needs and use cases that are found among them. However, far

too often, social scientific research relies on traditional models and methods of research, limiting the user base that is included and consequently restricting the potential findings before the research has even begun.

Inclusive research has developed in many forms during recent decades. Melanie Nind proposes that inclusive research is less a research method and more of a philosophy—namely, the belief that research participants ought to have more control over how research is conducted, more input into the meanings and outputs generated by the research, and generally a greater level of ownership of the research process (Nind 2014).

For Nind, the difficulty with much qualitative research, even some research that is described as “human-centered,” is its inherent power dynamics. She remarks, “Most qualitative research...retains the status quo of the researcher being the person who defines the questions, handles and controls the interpretation of the data, and makes and communicates the conclusions” (2014: 4). Inclusive research, in contrast, aims to disrupt this traditional power dynamic by shifting control and ownership to research “participants” (a term that should be used lightly, since people participating in inclusive research are usually better described as co-creators, collaborators, or co-researchers). Nind is acutely aware of this power dynamic: in shifting the balance away from the scholarly researcher, she advocates for “research *with, by* or sometimes *for* them...in contrast to research *on* them” (2014: 3).

There are a number of research forms that can be thought of as subcategories of inclusive research. Participatory research is a fairly conservative form compared to some others, although it seeks to involve “participants” to a greater degree than traditional research. “Emancipatory research” is far more political in its aims and it seeks the most radical refiguring of research power dynamics of any inclusive approach. Emancipatory research emerged from disability studies, where the distinction between research *on* and *with* was acute, and some of its goals are to make research and researchers accountable to the people impacted by the research, to provide opportunities for disabled people to shape and conduct research, and for research to improve the lives of disabled people (Ramcharan et al., 2008: 86, citing Chappell 2000).

The concept of research as emancipatory reminds us of the imperative to design inclusively. Steinfeld and Maisel define universal design not in terms of how many people it serves, but rather in terms of its ability to promote agency in users. Inclusive design is “a process that enables and empowers a diverse population by improving human performance, health and wellness, and social participation” (Steinfeld and Maisel 2012: 29). Considered in this way, the transformative power of inclusive design is clear, as is the need to include diverse groups (including individuals with disabilities) in design research.

## **AGENCY IN PARTICIPANT PHOTOGRAPHY RESEARCH**

Ethnographic researchers have long understood the value and power of photography. The ability of photography to make an argument in its own right—and to affect social change—has an even longer history. The late 19<sup>th</sup> century photographs of New York City by Jacob Riis are a famous early example, and the powerful Depression-era images by Dorothea Lange and Walker Evans are iconic representations of the hardships faced by Americans of the era. Photojournalists use images to tell a story faster, and with more emotional power, than words can convey.



The use of photography as a *participatory* method is far more novel in both academic and industry research. “Participant photography”<sup>1</sup> combines core elements of inclusive research with the apparent immediacy of photography to produce evidence and analysis that are otherwise inaccessible to researchers. Ozanne et al. argue that participant photography is primarily about granting agency to research participants. They write, “When people take pictures, they acquire great power to represent the personal, cultural, and economic influences that shape their lives and present obstacles to their vitality” (Ozanne et al., 2013: 46). The authors present examples of a number of methods of participant photography, but they repeatedly emphasize the active role of participants in shaping the research through their photographic choices. Participant photography thus draws heavily on the central belief of inclusive research that participants ought to control and guide research—that research should be *with* instead of *on*.

Steager similarly recognizes a central problem in ethnography that can be solved by participatory photography. Namely, since ethnographic research is necessarily and deeply subjective, how can researchers attempt to bridge the gap between their own perspectives and those of participants? As she asks, “How...to share what our eyes took in and our brain and psyche processed? How do we know if what we see is the same as what someone else sees?” (Steager 2018: 162). In other words, researchers always have their own subjective positions and perspectives, and as the “reflexive turn” of the 1980s has taught us, there is consequently no way to moot the subjectivity of the ethnographer. The solution proposed by participant photography is not to make a half-hearted and futile attempt at objectivity, but rather, to elevate the perspectives of research participants by giving them more agency over the form and focus of the research.

The various forms of photographic research in which participants wield the camera are not necessarily inclusive in form. Describing the method known as “photovoice,” Ozanne et al. say, “Although participants are given considerable freedom, researchers usually ask participants to focus on a specific subject matter” (2013: 47). In this form of photographic research, the researchers are still exercising considerable control over the form of the research, directing participants in specific directions that interest them. Steager recognizes this as a potential problem, in that it maintains the core authority of the researcher, and she thus distinguishes between photovoice and her preferred term, “participant photography.” She argues:

Participatory to me implies an active role on the part of the research participant, which is not always the case with photo voice. Rather than imposing my presuppositions on the experience and telling my participants what photos they should make, I wanted the participants to lead the process, not only in what and how they chose to photograph but also within the interview process itself when we discussed their photos, so that they were working with me to build a shared understanding, of a shared experience, of place. (2018: 163)

Ozanne et al. note that photographic research methods are especially prominent in research among marginalized groups. They argue that “because of their historical and ongoing experiences of oppression, these groups are often suspicious of outsiders (including academic researchers).” Consequently, “Photography is an attractive research approach because participants have greater potential power to author their individual and collective

stories” (Ozanne et al., 2013: 48). Clearly, then, participant photography is very much of a piece with the democratizing ideals of inclusive research.

For this reason, participant photography has the potential to generate tremendous empathy among stakeholders of a research project. Faulkner and Zafiroglu observe that “participant-made videos” “have a sense of immediacy and intimacy, and elicit emotional responses and curiosity to learn more on the part of our stakeholders. Unlike our [ethnographer-made videos], the videos our research participants make using video cameras...offer a glimpse of participants doing activities they normally just talk about when we are there” (Faulkner and Zafiroglu 2010: 114). Allowing participants to create the form of their story, rather than simply recounting it to a professional observer, creates an immediacy to the story that ethnographic accounts often lack. To some extent, this is likely just a property of the medium of photography (or, in Faulkner and Zafiroglu’s case, video): the visual form engages people differently than written or spoken text and it often feels more direct. But some of that directness also comes from knowing that the participants themselves created the visual products that relate their (own) stories.

And yet, while the rise of inclusive research has been driven substantially by research into disability and the social structures that produce it, there are remarkably few participatory models using multiple media in this realm. Of the multitude of examples of inclusive research presented by Nind (2014), only two involve participants creating in a medium other than spoken or printed words. This seems a remarkable shortcoming, considering how vehemently inclusive researchers advocate for participants to shape both their story *and* the form in which it is presented.

On reflection, though, there are some reasons why multimedia methods may be absent from inclusive disability research. First, inclusive multimedia research (such as participant photography) raises pragmatic and ethical questions beyond more traditional methods. Participants need to be literate in the medium to be employed, they need to learn how to use the equipment to conduct research (such as a digital camera or video recorder), and they need to understand the ethical implications of photographing people. Second, and related, inclusive multimedia research places substantial time (and possibly financial) demands on participants. Participant photography requires participants to invest a lot of time into the project, which can be a difficult demand of people in any circumstance. Only in a few circumstances can a researcher ask so much of participants and more traditional methods may be easier to implement in an inclusive way.

## Chuck

*Chuck is a quality assurance engineer for an e-book company, and he has been blind since birth. Chuck relies on sound to help him find his way and to stay safe. He described for me the sorts of information he can gather about his surroundings just from sound—echos and reverberations, subtleties that are many sighted people overlook:*

Walking down the sidewalk, I could tell if I was going by a parked car, you could hear walls far ahead of you. As I’ve gotten older this has diminished. However, I still feel very comfortable using a cane, and one of the things that I’ve learned is...that tapping of the cane is also a form of echolocation.

*After our interview, I went for a walk with Chuck and observed his listening skills in action. As we walked, he gently held my elbow—a technique called “sighted guide” in which a blind person receives directional signals from the movements of a sighted person—although his pace was so brisk and confident, I ended up feeling like he was guiding me from the shop back to his house. As we walked down the sidewalk of a strip mall, he pointed out the concrete columns as we passed by, noting that he could hear the change in the reflectiveness of the space occupied by each column. In his housing complex, he identified each house as we passed by based on the echo of its carport. (His always echoes more than those of his neighbors, because he doesn’t own a car.) On his own house, he had hung a windchime to help him identify it, but there was no wind that day, so Chuck had to find his house simply based on his mental map of the housing development.*

## AGENCY THROUGH PARTICIPATORY PHONOGRAPHY

When I began my research with blind users at Uber, I weighed the value of a participatory method. Obviously, a visual method like participatory photography was not viable, but I believed that a participatory *sound* method could reveal otherwise unavailable insights into the everyday realities of the research participants like Chuck. I will describe the particulars of my research design later in this paper, but here I wish to reflect more generally on sound as means of knowing the world and, therefore, its potential value to ethnographers who have largely neglected it in research methods.

First I offer a definition, necessarily vague but still useful in its inclusiveness: Sound is firstly a physical phenomenon, encompassing the compressions and expansions of air waves which for most people are interpreted by our brains as auditory phenomena. (Sound vibrations can also be felt in the body, particularly at very loud volumes and very low frequencies.) While such a definition may seem too broad to be of much value, it is essential for what sound is not (or at least, not only): music. Music is neither coterminous with sound (which should be obvious), nor is it precisely a subset of sound (less obvious, unless you have encountered the work of historical musicology, which very often has nothing at all to do with sound). The world is saturated with sound, very little of it music. In this paper, and indeed, in this research method, I am not concerned with music, but instead, with the rather less remarkable quotidian sounds that permeate our everyday lives.

And it is because I am interested in the ordinary lives of people—the day-to-day travails with transportation and mobility that all blind or visually impaired people deal with—that I wanted to use a *participatory* sound method. As Faulkner and Zafiroglu observe about their participatory video research method, giving the participant independence and control over their self-representation ultimately give the researcher access to parts of the participants’ lives that would otherwise be off-limits. Their participants “captured scenes and moments that we were not invited to witness first-hand, and that any outsider would be unlikely to see. The videos are simultaneously intimate and mundane” (2010: 117). Thus, why I conceive of my research method as “hearing through their ears,” attempting through a participatory multimedia method to access the subjective sonic perspective of blind individuals, to understand how they navigate their worlds using sound, and to figure out what sorts of needs they have that are not being met.

I can find no attempts to employ a sound epistemology in design research. There are, of course, researchers who have considered the design impacts of sounds in their products (see Case and Day 2019), and “earcons” are becoming a mainstay of UX and UI design. These are important and insightful uses of design through sound; however, here I am interested in

something slightly different (though related). I am interested in how sound can be used as a means of understanding the world—and, just as with visual means, how individuals have unique subjective experiences of the sound in the world around them.

My primary inspiration for the sound recording component of my research comes from the work of the prominent ethnomusicologist Steven Feld. Feld has conducted research over several decades among the Kaluli people in the Bosavi rainforest of Papua New Guinea, and during that time, he grew increasingly reflexive and inclusive in his research and analysis. *Sound and Sentiment*, his first book based on his Bosavi research, was published in 1982; five years later, he described a process he called “dialogic editing,” an effort to include the Kaluli people in critical commentary on his book (Feld 1987). Feld took the dialogic editing method a step further when he partnered with drummer and producer Mickey Hart to release an album of Kaluli song and rainforest sound, *Voices of the Rainforest* (1991).

For the *Voices of the Rainforest* project, Feld used recording and editing technologies to construct an hour-long sonic evocation of a full day in the life of the Kaluli. He recognizes that such a recording can provide an evocative first-person experience of the rainforest in a way that a text—or even a record of discreet tracks (the more standard form of academic ethnomusicological releases)—could not. “Without academic explication,” Feld says, “the recording allows the listener to enter and subjectively experience what the Kaluli call *dulugu ganalan* ‘lift-up-over sounding’ [the complexly layered acoustic world of the rainforest]” (Feld 1994: 280).

Further—and most important for my purpose in this paper—Feld developed a participatory research method in order to create a recording that was engaging and authentic to the Kaluli experience. Using a variety of microphones, he captured the overall sonic picture of the rainforest, but he also used parabolic microphones to record the sounds of birds and insects in isolation, to be mixed in later. In fact, Feld asserts that recording enabled him to understand the Kaluli sonic ecology in a way that he couldn’t before, as his Kaluli informants became collaborators in the production of the record. “Playing back transfers of component tracks on two cassette recorders, I asked Kaluli assistants to adjust volume controls on the two machines until the composite sounded good to them. When the tracks combined musical performances and environmental surround sounds, Kaluli tended to amplify the surround tracks, particularly on the middle and upper forest canopy... This kind of bush premixing studio put Kaluli in a directly dialogic editorial role in the project” (Feld 1994: 283).

Rereading this passage now, I am amazed at how forward-thinking Feld was in the research design. Certainly, he did not abdicate his authority as a researcher, but his methods are remarkably participatory, particularly by the standards of ethnographic research as it was practiced in the early 1980s. He allowed the participants in his research to become co-creators of the research product, directly shaping what would become a major-label release in the United States. (Feld was also acutely aware of the potential ethical problems of this work: while he retains legal authorship of the record—and there was no way around this, since American copyright law does not make allowances for the notion of cultural ownership—he attempted to mitigate the privilege of ownership by creating a trust to receive royalties from the record’s sale and using those proceeds to support conservation work in Papua New Guinea.)

In addition to Feld’s participatory research design, there is an instructive lesson in his discussion of “lift-up-over sounding,” the term that refers to the sonic density of the

rainforest, the Kaluli's interaction with it, and the system of knowledge that encapsulates it. The Kaluli's worldview cannot be disentangled from their singing: their singing is always in dialog with bird song, and these conversations with birds are how Kaluli know about the world around them. There are two key points here. First, to grasp their meaning and importance, sounds need to be understood in context rather than in isolation. And second, sound (for the Kaluli and more broadly) is not only the content of knowledge, but is actually the medium in which knowledge is acquired and communicated. Feld is acutely aware that written language can, at best, only provide an approximation of Kaluli knowledge; the knowledge is the medium of sound itself.

The sonic contexts like the Bosavi rainforest can be referred to as "soundscapes," a term popularized by the composer and ecologist R. Murray Schafer. Schafer describes the "soundscape" "as any acoustic field of study" (1977: 7), an inclusive concept that can refer to any sound environment in its totality. There can be natural and human-made soundscapes; urban and rural soundscapes; dense and sparse soundscapes. Schafer further introduces three kinds of sound that constitute a soundscape: "keynote sounds," which are the constant and often unnoticed features of a soundscape; "signals," which convey needed information and are therefore consciously listened to; and "soundmarks," which (via the visual term "landmark") denote sounds particular to a place or community (Schafer 1977: 9–10).

The soundscape and its related concepts are not analytical unto themselves. They simply provide a framework through which we can perceive and organize sounds in any given location. The analytical value of the soundscape emerges when we begin to describe and contextualize the meanings of sounds. Moreover, these concepts are not static; they can change as a soundscape changes, and as the people occupying it change. For example, the soundscape of the street where I live is generally quiet. Few cars drive past, and the relative quiet is punctuated only by the fleeting conversation on the street or a barking dog (often my own dog). These are the "keynotes" of the soundscape. Recently, however, construction crews began major work on three houses on my block. They arrive early, yell jovially across the street, and hammer loudly throughout the day. These sounds were "signals," in that they were consciously perceived and, at least when walking on the street, conveyed necessary information. However, over time, these sounds have become so routine that they, too, have become keynotes. Finally, the weekly tolling of the local church bell is a soundmark, signaling the presence of the church to everyone in the neighborhood.

These layers of sound are valuable because they capture the different registers in which people listen to sound as part of their lives. The brain is quite adept at filtering out the "noise" of everyday life—treating such quotidian and unnecessary sounds as "keynotes," to use Schafer's terms. However, because sound is so present and informative, it is also a fertile ground on which to understand people's experiences and to inform design decisions. In the rest of this paper, I will describe and reflect on my efforts to use sound as part of the research process with blind people, and I will provide some ideas about how sound can help researchers in the future.

Finally, as both Feld and Schafer recognized, sound recording can be an extremely engaging medium, and as such, it can generate awareness and empathy among listeners. I believe that much of the value of sound recording in industry is its ability to give a variety of stakeholders insight into otherwise invisible user experiences—but doing so requires some knowledge of how recording works. Recordings convey movement and dimension through

the stereo field, loudness, and harmonics. Stereo recording has been used since the 1950s to convey position and lateral movement; its use in this way was pioneered by the producers and engineers at Decca Records and used to convey drama in opera recordings. The feeling of “depth” in a recording—the impression of space on a line away from the listener—is more complicated to create. Volume plays a partial role: a sound getting louder can give the impression that the entity generating the sound is getting closer to the listener. However, loudness by itself is not enough. Harmonics play a role, too. Higher frequencies dissipate faster than lower ones, so a sound with fewer high overtones (pitches that can’t be heard individually, but which contribute to the overall “color” of a sound) is perceived as being farther away than a sound with a lot of high overtones. Knowing all this, one could fairly easily make a recording of traffic that conveys the movement of cars around the listener, creating a purely sonic experience of traffic and thus conveying a trace of a blind person’s experience of crossing the street.

## Laura

*I went on a “soundwalk” with a participant named Laura. We took a trip that she often takes when she does her shopping: a shared Uber to the grocery store, walking across the street and down a half mile to the Target, and then to the bus stop behind the Target. Laura gets around with a white cane and her mental map of the area. She narrated during quite a bit of the recording, including explaining how she finds the correct bus at a station with three separate shelters. As we walk past the shelters, she tells me, “I had a friend help me memorize which buses are at which [shelter]...because you’re not always going to have mobility training.” What was most interesting, though, is how Laura orients herself in this location and finds the correct bus stop. “I know when I’m near the bus shelter because my voice will echo. That’s how I know I’m passing the shelter.” She stopped and gestured towards the second bus shelter: “I know there’s no people in here because it’s super echoey.” Focusing my attention, I heard Laura’s voice echo in the shelter as she spoke; and listening later, I noticed that the recording had captured the echo, preserving a sonic element that Laura uses to navigate without much conscious effort.<sup>4</sup>*

## DOING PARTICIPANT PHONOGRAPHY

Because I wanted my research design to be as participatory as possible, I initially intended to equip research participants with their own microphones. I debated the merits and drawbacks of two different sorts of recording devices: a stand-alone digital recorder and a microphone that plugs into the lightning port of an iPhone. The stand-alone recorder would have been easier in the long run, but it would require more effort for participants to learn how to use it. The iPhone microphone would work with a device that participants already owned, so I ultimately decided to go this route. I selected a microphone and Uber’s Research Operations ordered four of these devices for me. Only then, when I unpacked one and began to use with it, did I discover an insurmountable problem: the microphone wasn’t accessible.

I learned that once you plug the microphone in to the phone’s lightning port, there is no way to get the phone to give audible VoiceOver readouts. (VoiceOver is the accessibility feature on the iPhone that allows blind users to interact with the phone via sound and touch.) Since the research participants rely on VoiceOver to use their phones, plugging in the microphone essentially made their iPhones completely unusable. There would be no way

for them to navigate around the phone because the audible cues and readouts that they used were simply not available. I contacted Apple and the microphone company, and they predictably blamed each other for this problem. However, they agreed that it was indeed impossible to use a lightning port microphone with VoiceOver, and my initial research plan was scuttled before it even got off the ground.

Back to the drawing board. I decided not to return to the option of stand-alone recorders, a decision I made primarily because of the time constraints on my research and the additional demand it would place on participants. Instead, I opted to try a form of co-creation with participants, where we would together use my own recording equipment to make recordings. The first few attempts at co-creation showed some promise but were not ultimately as collaborative as I hoped. These mostly involved me walking along with a participant as they narrated their experience, highlighting sounds that were giving them useful information about their surroundings. The process was certainly insightful—for instance, several people demonstrated how the combination of sonic and haptic feedback from their cane can convey critical information about an environment—but the resulting recordings had very little that I could play for others as a representation of a blind person's experience of the world.

Unsure why the co-creation process did not go as I hoped, I stepped back and tried to workshop it with colleagues in Uber's office. Several people volunteered to be guinea pigs for me, and I gave them instructions about how to use the equipment and what I hoped to capture, just as I had done with the blind research participants. The workshopping of the method was extremely revealing. All of my colleagues insisted on moving around with the microphones, even when I explicitly instructed them to remain in one place. They were very surprised to hear how differently the office sounded through microphones and headphones, compared with their normal experience. I discovered that I needed to give much more specific instructions in order for participants to make clean and insightful recordings.

Emboldened by my experiments with my Uber colleagues, I decided to do another round of recordings where I was more explicit and insistent in my directions. I instructed participants to select a location to record, and to remain stationary in that location. Having found a safe place to stand, I gave them instruction in how to use the recording equipment: the broad sweep of the stereo pair of microphones and the highly directional shotgun microphone. I insisted that participants wear headphones so that they could hear what they were capturing on their recordings. The participants who did this were initially quite uncomfortable with the new sonic surroundings, but they adapted quickly and seemed to be intrigued by this new sonic perspective on the world.

## Christina

*I met Christina at a school for the blind where she had been living for the past few months. Christina had lost her sight a couple years ago, and at the school, she received training in how to go about ordinary tasks without sight. She used to take for granted her ability to go to the nearby Starbucks for a coffee, but now she was relearning how to walk in a straight line and safely cross the street. She explained to me that sound is crucial in crossing the street. Sometimes, signaled intersections have special auditory signals for blind pedestrians that indicate when and in which direction a light is green. Even so, Christina has been taught to always listen for traffic: if the traffic is moving parallel to you, then you can move with it, but if it is perpendicular (i.e., across your path), then you need to wait for the light to change.*

## REFLECTIONS ON THE RESEARCH METHOD

Although my research was not as participatory as I had initially hoped, my project indicates that there is value in participant phonography. Even in its imperfect initial forms, the research revealed key elements of participants' sonic worlds, sound cues that they rely on that might otherwise escape notice of a researcher. These were classic "soundwalks": "a form of active participation in the soundscape...the purpose of [which] is to encourage the participant to listen discriminately, and moreover, to make critical judgments about the sounds heard and their contribution to the balance or imbalance of the sonic environment" (Truax 1999). Participants recounted some very valuable insights about how they use sound in their everyday lives. Those individuals who were blind since birth told stories about using sound without even realizing it; it was second-nature to them. For instance, Chuck, who I mentioned earlier, told me about running and climbing trees as a child, oblivious to any potential limitation from his blindness. Participants who had lost their vision more recently had often learned to use sound as a navigation tool through mobility training, such as learning to listen for the sounds of traffic moving parallel and perpendicular to them at intersections, as Christina learned. These were key insights into the quotidian experiences of the blind individuals whose mobility experiences I was hoping to help improve.

As useful as these insights were, however, my initial methodology was only minimally "participatory." There was very little real collaboration in those interactions—very little control given to (and taken by) participants—and both I and the participants fell into our familiar roles of researcher and researched, respectively. I discovered that many of the people I worked with had participated in some sort of research before—not with Uber, but with a number of other companies who had already been trying to understand the experiences of blind users. Looking back, I believe that many people I interviewed were accustomed to the traditional dynamic of having research done *on* them, and they were uncomfortable with my proposal to do research *with* them.

The last few recordings were much closer to what I envisioned, in that the participants physically took charge of the recording equipment and the recordings were, in a very real sense, *theirs*. The insights generated in those recordings are, in large part, the product of the agency taken on by participants. By listening to the recordings as they were happening, they were able to focus attention on sound elements that were important to them, and to create recordings that offered more of a first-person experience of their sound worlds than I might otherwise have gotten.

At the same time, I have some ethical qualms with the methodology as I implemented it. By insisting on certain parameters for the research, I was perhaps undermining my desire to shift the balance of power away from myself. I insisted that participants stay in place; that they wear headphones during the recording; and that they hold and aim the microphones. While participants were generally curious and willing to try this, it was clear that they were initially uncomfortable with what I was asking of them. The discomfort I caused these people troubles me. How can I claim to be conducting ethical research when I was asking participants to do something they would otherwise prefer not to do? Is it possible that the participants in the research were opposed to what I was asking, but felt that they couldn't refuse or challenge my instructions? Like most researchers with good intentions, I want to



believe that this was not the case, but because of the engrained power structures around ethnographic research, I cannot be certain.

## **POSSIBILITIES FOR PARTICIPATORY RESEARCH IN A CORPORATE CONTEXT**

My approach to this research was substantially shaped by the corporate context in which I was conducting the research, which in turn created some of the ethical dilemmas I continue to grapple with. I was working for Uber, and while some of my remarks here may be construed as critical of Uber specifically, I insist that my observations describe the constraints and pressures of conducting ethical research in industry more generally.

As my research plan began to take shape, it quickly became apparent that recruiting participants for my research would be no easy task. Like far too many companies, Uber had no procedure in place to conduct research into the experiences of blind users (or users with any disability, for that matter). Most of my colleagues can easily find a group of potential participants in the company's database by identifying key characteristics like number of rides or frequency of use. However, because Uber does not ask blind users to self-identify (an issue that would be a major point of discussion and debate later in my research), there was no way for me to internally identify potential research participants.

Thus, the first ethical challenge: how could we recruit a reasonable pool of blind Uber users without violating people's privacy? We solved this problem by approaching organizations in the Bay Area who serve people with visual disabilities and asking if they could pass on our screener to their constituencies. As long as we did not retain any internal record of the research participants, this met the company's mandate to not identify users by their disability. However, it created a new power imbalance between Uber, the large for-profit corporation, and the relatively small non-profit organizations we approached for help.

Mobility is a substantial challenge for people with visual disabilities. Driving oneself is not an option, public transportation options are very limited and time consuming, and private rides can be extremely expensive. Consequently, the organizations we approached for help with recruiting participants were excited that Uber was investigating the experiences of blind riders. However, while they all had institutional structures in place to help companies with recruiting blind participants for corporate research, Uber had never before undertaken this sort of research and it would not have been possible to onboard these organizations as "vendors" within the time frame of my research. Thus, I was in the very uncomfortable position of asking small non-profits essentially for a handout to the large corporation: forwarding our screener to their constituencies for free. We were very humbled by the willingness of people to help—and it bothers me immensely that we were not able to do anything reciprocal to help the organizations that assisted us with the research.

After the recruiting challenge, a second ethical matter arose. Namely, how much participation could I reasonably ask of people? One challenge with using participatory research methods in a corporate context is that these methods often require much more time from participants than traditional user research techniques. Under my initial plan, I would have asked participants to spend time over the course of a week making recordings, and then to talk with me about them. Even in the revised research plan, I needed time to explain my methods and goals to participants, to teach them how to use my recording equipment, and

to make and reflect on recordings. The method cannot easily fit into the 45-minute or 1-hour research sessions that are typical of this type of user research.

In her manual on the topic, Nind (2014) provides many examples of successful inclusive research designs. Interestingly—and tellingly—none of her examples are from industry. There are cases where research is led by non-professionals, cases where academics and community members collaborate on research, and examples of academics involving participants in more substantial ways than is typical of social science research. However, she has no examples of how inclusive research design can be used in industry. I imagine this is less an oversight of Nind's and more an illustration of how difficult it will be to introduce truly inclusive research design into a corporate context.

Because of the constraints of time, confidentiality, and finance that I faced at Uber, the participatory phonography method as I enacted it barely meets the broad criteria for “inclusive” research. My methods were indeed participatory, but not nearly to the degree I had hoped in the early stages of my research design. The empathetic value of a user-created soundscape recording never came to fruition (although I fortunately had plenty of other evidence that I could deploy to generate empathy and insight among my colleagues).

Reflecting on the project, I sense that researchers in industry who want to work inclusively are trapped between two opposing forces. On the one hand, we recognize the moral imperative to work inclusively if we are to generate meaningful insights into the experiences of people who typically exist at the margins of industry research. Inclusive research can both convey these perspectives *and* allow these individuals to retain control over their own narratives. On the other hand, the structures of industry research discourage the sort of inclusivity that has been so successful in academic and community research. There was no possibility for the participants in my research to have “ownership” over the research at Uber in any meaningful way, no matter how much I may have wished it to be so. I am left rather pessimistically wondering whether it is *ever* possible to do truly inclusive research in a corporate context.

Of course, I am not arguing that we should not do research among groups who are not often represented in our studies. To the contrary, it is essential that we advocate for such research in corporations because, as human-centered researchers, we are uniquely trained and positioned to push companies in socially progressive and inclusive directions, and we have a moral obligation to do so. However, I am also questioning the possibility of doing research that is inclusive within these corporate contexts.

How can we develop relationships over time with participants in a way that is collaborative and not exploitative? I was often acutely aware while interviewing blind individuals in the Bay Area that my mere presence in their homes was sending a message about Uber. Even though I was very careful not to promise anything about how Uber's service might be improved, I often realized that simply by asking them about their mobility experiences, they got the impression that the company wanted to understand their challenges and to help. Of course, anyone who has worked in a company will know that things are never so simple. We learn about users and we advocate for them in the push-and-pull of company politics and priorities. Some of our suggestions are taken up; many others fall away, seen as unnecessary or unworkable. That has been the case with my research: after I left Uber, there were improvements made to the accessible version of the rider app, but they were mostly nibbling around the edges. More substantial changes have been taking place, but at the slower pace that is unavoidable at a large corporation.

In a context like this, it could be deceptive or outright wrong to ask participants to invest the time and effort required for a truly inclusive research collaboration. The benefit to the company is clear: more knowledge of their users, more data about how their service works, more opportunities to turn these insights into profit. But what is the benefit for the potential co-researchers from outside the company, such as the blind individuals with whom I tried to co-create soundscape recordings and gain insight into their sound worlds? Unless they can advocate for their own needs in the corporate structure—in other words, unless they can own the research and speak for themselves—they can't ever be sure that they will benefit from a deeper research arrangement with the company.

## Katie

*Katie told me about a serendipitous experience she had finding an Uber ride she had ordered. She was waiting for the car to arrive in a difficult pick-up location, a narrow and crowded street with a lot of construction noise. As she usually does, Katie called her driver to tell him that she is blind and would need him to look for her. While she was on the phone, her ride pulled up. Katie described the experience:*

I was on the phone at the time and a car pulled up, and I heard my voice coming out of it. I heard their voice coming out of two places at once. So ok, there's the car.

*Completely by chance, the driver had been talking to Katie on his car's speakers, so she could hear her own voice coming from his car, as well as his voice in both her phone and the car. This was not an intentional design solution (although it could be), but it was an absolutely perfect way for Katie to identify her ride through her sonic awareness.*

## FINAL THOUGHTS

So where does this leave us? In general, companies have largely gotten better at creating products that can be used by people with diverse abilities, and the best companies even conduct user research into experiences of disabled people. But on the whole, industries are nowhere near truly inclusive research and design. Disabled people continue to be thought of as a “niche,” users who exist on the margins of companies' core users, but such thinking will increasingly have adverse consequences for businesses—consequences in the form of financial losses and missed opportunities, as well as discrimination lawsuits against companies that exclude disabled users. Companies need to understand that inclusive design is not a niche; it is good for business.

The only path to inclusive design is via inclusive research, and the responsibility pushing for inclusiveness therefore falls on researchers. My acoustic anthropological methods are only one way of working inclusively. Participant phonography is not appropriate in all research situations, but as part of the ethnographer's sensory toolkit, it can provide a richer insight into the experiences of particular users. Such various sensory methods are necessary for inclusive research because they address the diverse ways that people experience the world. Only by adapting our methods to the needs and experiences of our users can we conduct research that faithfully represents their perspectives and ideas.

**Gregory Weinstein** is a design researcher and acoustic anthropologist based in Pittsburgh. After spending his first career teaching writing and studying the classical music recording industry, he now conducts research in areas such as disability, transportation, and sound. He makes soundscape recordings for fun, as well as for work. [mahler123@gmail.com](mailto:mahler123@gmail.com)

## NOTES

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1. You can hear an excerpt from my soundwalk with Julie here: <https://soundcloud.com/mahler123/market-street-clip-mixdown-1/s-LhAkU>. This clip has not been edited, other than selecting it from the more than 20 minute recording and mixing the three tracks down to stereo. In it, you can hear a lot of ambient city noise: a streetcar's poles on the overhead electric wires, trucks bumping on the uneven road, an audible signal of a walk sign. There are lots of people speaking, although they're mostly indistinct—except for the woman who apologizes after walking into Julie while we were crossing the street. Shortly after, Julie praises her guide dog for navigating the busy crossing and finding the sidewalk. Note: this clip is under copyright and cannot be shared or reused for any purpose.

2. Different people make different arguments about how to refer to people with disabilities, and blind people specifically. There are conflicting arguments about whether it is preferable to use “people first” language (i.e., “someone who is blind”) or “disability first” language (“a blind person”). In this paper, I vary between the two, primarily because that reflects the variety of ways the participants in this research referred to themselves.

3. There is no single name for this sort of participatory visual research. However, Steager (2018) adopts the concise phrase “participatory photography.” I like this phrase, and I use it and “participant photography” interchangeably throughout the paper.

4. You can hear an excerpt from my soundwalk with Laura here: <https://soundcloud.com/mahler123/laura-soundwalk-clip-mixdown-1/s-pCtXv>. This clip is only the mono recording from my shotgun microphone, because this track captures both the ambient noise of the bus shelter and, critically, the change in the reverberation of Laura's voice when she is standing in front of a bus shelter. Note: the clip is under copyright and cannot be shared or reused for any purpose.

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## The Adaptation of Everyday Work in an Age of Automation

TAMARA MOELLENBERG, *ReD Associates*  
MORGAN RAMSEY-ELLIOT, *ReD Associates*  
CLAIRE STRATY, *ReD Associates*

*Recent debates around the future of work have largely focused on how automated technologies are contributing to job loss or decline. However, in this paper, we draw from original ethnographic research with four types of automation-affected workers – insurance agents, pharmaceutical representatives, medical device salespeople, and medical device technicians – to argue that, rather than being replaced by machines, many workers are in fact adapting how they define and perform their work to survive in a more digital age. Uncovering such adaption tactics is crucial for recognizing the human agency that is present in, even definitive of increasing encounters with machine-driven technologies and can help large organizations solve some of their toughest challenges, including how to predict future trends in the labor market, define the added value of human labor, build and train a better workforce, and develop and evolve existing digital tools.*

### INTRODUCTION

One fellow adjusts his cowboy hat. Another, long tattoos snaking down his arms, leans back skeptically. A third shuffles nervously in his chair. Truckers all, and the subjects of a new Vice documentary on *The Future of Work*, they've just met the Chief Product Officer of a company that is engineering self-driving big rigs capable of navigating the roads completely autonomously. This technology has the potential to displace 10 million jobs, the CPO tells the camera. Not only are these workers facing a jobless future, according to the makers of the *Vice* film, but they are also are unprepared for it. "When you asked me, what would I do if I didn't drive? I honestly can't answer that, because I really don't know what I would do..." one of the truckers says to *Vice* host, Krishna Andavalou, "I've been doing this too long." Layering a melancholy soundtrack over slow-motion footage of the man's rig backing out into the night, the filmmakers present the worker as both unwilling and unable to change, so long stuck in one way of being in the world that he cannot even contemplate transitioning to another.

This is of course a poignant image, and a much-needed reminder of the human lives at stake in the rush toward new technologies; without outside help or training, many workers may indeed struggle to adapt to an increasingly digitized future. However, replicated unthinkingly, we also find this to be a problematic depiction of the worker as someone without agency, lacking the drive, creativity, ability or resourcefulness to adapt in meaningful ways to automation-driven change. By contrast, in our extensive ethnographic research with (admittedly white-collar) professionals across America and internationally, we have seen a different narrative emerging, one in which ordinary workers are both aware of the advanced technologies transforming their industries and incredibly inventive, finding ways to adapt to these technologies by changing how they think about and describe their jobs, the daily ways they operate, and even the kinds of customers they serve, as we go on to discuss in our findings section. Much of the contemporary discourse around advanced technologies has

embraced a narrative of “technological determinism,” in the words of information technology scholars Howcroft and Taylor (2014), presenting the development of these technologies – and their displacement of workers – as inevitable, or destined to transform society in quite damaging ways. We submit that this elides the agency that ordinary workers are exercising to resist these technologies, and the power they have to shape not only the ways these technologies are designed and implemented, but also the impact they have on worker’s lives – and society more broadly.

Take, for example, Paul, a medical device technician, who is embracing a softer language of “patient care” to describe his role in not only troubleshooting issues with medical devices, but also teaching patients how to use them properly; Cynthia, a pharmaceutical representative who is finding new ways of delivering value to clinicians, for instance by introducing them to methods and studies; or Melissa, an insurance agent who has shifted her entire business to serve a more asset-rich customer. In each case, the professionals’ actions can be explained as a resilient response to increasing automation and digitization in their industries, for instance, to medical devices that are increasingly able to troubleshoot problems and relay information autonomously, without lesser need for an in-home technician; and to competition from direct-to-consumer websites, which enable insurance customers and clinicians to purchase products without the help of an agent, dealer, or representative. By framing their actions *as responses*, signifying purpose, intention, and method – sometimes, even being rewarded with success – it becomes possible, we argue, to recognize these workers *as agents* taking measures to protect the future of their livelihoods; not, as the *Vice* documentary would frame them, passive, unwitting victims displaced, or, in the words of another commentator writing in *The Guardian*, made “disposable” by new, more advanced technologies (Murphy 2017). Furthermore, recognizing workers’ agency is important for many reasons, not least because it is often a missing variable in predictions of the future of work and workplace technologies.

## OBJECTIVES

When making predictions about future unemployment as a result of automation – a much-debated topic in academia, policy-making, as well as popular media – it is not enough, we argue, to simply calculate the percentage of cognitive or manual tasks within a given job that could theoretically, or in the near future, be accomplished by a computer, which is (roughly speaking) the method employed by oft-quoted commentators such as Frey and Osborne (2013). This is because such predictions do not take into account the *new* value that workers are creating to stay competitive against these technologies, which affects the pace at which they will or even *can* be replaced by advanced technologies. Consider, for example, the insurance agents who are competing with automated websites by going beyond simply selling policies to also providing other forms of risk-related value, such as workplace safety training, as we go on to discuss. Meanwhile, workers who are creating new kinds of value in this and other ways will continue to persevere in their jobs, which should be factored into predictions about the impact of advanced technologies on human behavior – and society more generally.

Another practical application of the research we go on to discuss, though a less desirable one, is the development of even more advanced or competitive technologies by learning from workers’ adaptation practices: for example, while today direct-to-consumer websites

primarily match customers to (simple) policies via algorithms, in future, they could also become centralized platforms for a suite of other services that include, for instance, safety training, thereby learning from or mimicking what human agents are currently doing. This of course raises questions about the ethics of recruiting ordinary workers into ethnographic studies – gaining access to their homes, communities, and workplaces in the process – with the explicit intention of using this data to develop technologies that put their livelihoods at even greater risk. It also assumes that that more automation is always preferred, if not always more cost-effective, a highly suspect view for reasons that include the capital it takes to develop such technologies: see, for instance, Steve Lohr’s (2019) recent article for *The New York Times* on the often prohibitive costs of training artificially intelligent systems.

Fortunately, studying workers’ adaptation practices can not only guide the development of new technologies that compete with them, but also help them. That is, instead of *prescribing* how workers can or should evolve, for instance, through a broader analysis of industry trends, we argue there is more opportunity to learn from what workers are currently doing, and *partner with* them in changing how they work to keep pace with new technologies: for instance, providing software tools to insurance agents that help them quote policies and get back to their customers faster – an observed and explicitly-stated need, as we go on to explore below. This application of our research may be particularly relevant for organizations that wish to demonstrate their loyalty to – and partner with – workers as they grapple with change in automation-affected industries: for instance, pharmaceutical companies that employ both human and digital “agents” to sell their products. Workers often have an idea of how they would *like* their jobs to evolve to stay both meaningful and profitable to them, and they can be shrewd assessors of the kinds of tools-, skills- and knowledge gaps they must close to stay competitive, as we go on to show. Tailoring solutions to address these gaps can be an effective way both to build closer relationships with automation-affected workers, and help them to adapt to change successfully.

To be sure, as we go on to explore below, adaptation is not always easy. While workers may have an idea of how they would *like* their work to evolve to compete with new technologies, they often lack the practical resources to do so, which presents opportunities for organizations with a stake in these workers’ survival – e.g. governments, foundations, suppliers – to assist and, thus, build closer relationships with them. This paper uses the term “tactics,” as defined by Michel de Certeau (1984) in *The Practice of Everyday Life*, to describe how workers are adapting to new technologies precisely because it encapsulates the limitations of their responses. Unlike “strategies,” according to Certeau, tactics are fundamentally defensive; workers have no “base where [they] can capitalize on their advantages,” or secure whatever gains they may have made (xix). Similarly, today’s workers must evolve further to stay competitive; there are few adaptation methods that put them permanently beyond the threat of advanced technologies, and even short-term gains can be difficult to secure with the limited resources they currently possess, as we go on to show. This paper proceeds to discuss some of the occasionally intractable challenges hindering these workers’ ability to compete with advanced technologies – including, rather ironically, their struggle to access sufficiently sophisticated digital tools in their daily work – while also illuminating possible ways that outside actors, for instance our clients, can help.

But what about the ways that we, as applied ethnographers, assist *our clients*? As yet another, perhaps principal, application of the research we disclose below, insight into the unique value that humans contribute over automated services may also help firms pursuing



multi-channel strategies to develop a coherent vision of when a human agent or sales representative, for example, is more valuable than an algorithm. Several EPIC community members including Oreglia and Kitner (2013) have discussed the critical role of salespeople as “gatekeepers,” shaping how customers see and even use many products. For instance, even though many direct-to-consumer websites today are capable of selling personal lines policies to (moderately) high-net-worth individuals, *should* they? Or would marketing dollars be better spent in funneling these customers to human agents who are both more skilled at selling them the complete package of coverages they need, as well as more adept at keeping these customers with providers long-term by delivering the “white glove” service they expect? As applied ethnographers, one of the primary ways we can be useful to our clients is by unravelling their established orthodoxies not only about the technologies they adopt or implement, but especially about the designated roles and presumed value of the people they employ.

## LITERATURE REVIEW

Are automated technologies good or bad? In the future, will they lead to mass unemployment or help make work more fulfilling for more people? These questions obviously have major social, political, even environmental (Ford 2015) implications and, thus, have occupied scholars from a range of fields. As early as 1974, political scientist Harry Braverman argued in *Labor Monopoly and Capital* that companies are and will continue using automation to replace or simplify skilled jobs. Braverman viewed such technologies as a tool of control by management, leveraged to weaken the power of workers in the labor market and hence to strengthen the position of the company. Notably he thereby elides the leverage that *workers* have in their unique skills, talents, and particularly resourceful agency, as we go on to show. Subsequent scholars refer to this as “Braverman’s universalist thesis of deskilling” (Bricken et al 2017, 4); according to his theory, machines will eventually, universally, replace workers. Many commentators since have embraced similarly fatalistic concerns. For instance, Brynjolfsson and McAfee (2014) raise anxieties about deepening social inequality as result of advanced technologies. Only some highly skilled workers will be able to “create and capture” the value of these technologies, they argue, while other, “ordinary” skilled workers will likely become susceptible to substitution, seeing their wages fall. Martin Ford (2015) even goes so far as to warn of worsening climate change as a result of automation when, faced with economic insecurity as a result of widespread worker displacement, politicians will prove even less capable to “address the dangers posed by climate change” (283-4).

Indeed, much of the contemporary discourse around automation in the workplace is haunted by a sense of impending doom for workers. *The Wall Street Journal* warns of “White Collar Robots, Coming for Jobs; *The Economist*, often fairly optimistic in its approach to new technologies (not to mention conservative in its projections) submits, “The combination of big data and smart machines will take over some occupations wholesale, [or in others] allow firms to do more with fewer workers” (2014, 23). Though, of course, some academics have been more circumscribed in their predictions: Oxford professors Benedikt Frey and Michael A. Osborne (2013), for instance, estimate that nearly half (46%) of American jobs may be susceptible to substitution by automation in the next two decades, but, crucially, they do so without making any predictions about the number of jobs that will *actually* be automated, nor

do they speculate about what the consequences of rising automation are likely to be. And circumspection *is* required: as scholars such as Teigland and colleagues (2018) have also noted, the extent to which automated technologies will be adopted, particularly as a replacement for human workers, is likely to depend on a number of external variables, including but not limited to the commercial availability of these technologies; the cost of implementing them; their perceived economic benefits; and evolving legal, ethical, and other regulatory frameworks that govern them, which may constrain where and how such technologies may be used, or what protections will be available to workers.

We aim to add another variable to this (by the perspective of some, comforting) list: the adaptation of everyday work by the ordinary worker. To reiterate, we submit that it is not possible to predict the extent to which automated technologies are or will be “displacing” workers without understanding the ways these workers are already responding to, and even successfully resisting, the effects of these technologies on their work. As social scientists have been arguing for decades, technologies are not created nor adopted in a vacuum; rather, they “exist and function within social systems and are consequently conditioned by them,” in the words of esteemed anthropologist Leslie T. White (1959) (27). Hence, in order to make predictions about the future of the workforce, or even to understand the relationship of workers to new technologies in the present day, it is paramount to understand how ordinary workers are using advanced technologies in their daily practices; how they see themselves in relationship to new digital competitors; how they are evolving their work to stand out from these competitors; as well as what challenges they face throughout this process.

Fortunately, a number of scholars in the fields of Labor Process Theory, Information Systems (IS), Social Shaping of Technology (SST), as well as the EPIC community have redrawn attention to the modern workplace as a “contested terrain” in the words of labor process scholars Thompson and Harley (2007, p. 149) – that is, as a space not only where advanced technologies are playing a more prominent role, but also where human agents are taking steps to counter their (sometimes nefarious) effects. Borkovich and colleagues (2016), for instance, have explored how office workers are repurposing the very connected devices (e.g. cell phones, mobile computers) that render them “always on” at work, or more susceptible to the demands of their employers, to practice *perruque*, that is, to “pilfer” their employers’ time for their own personal, private purposes (5). Moore, Aktar and Upchurch (2013), similarly limn the subversive practices of warehouse workers who, when instructed to wear new technologies designed to monitor productivity and performance (e.g. step counters, movement trackers, even heart rate monitors), decided “not to care,” in the words of one laborer, actually reducing the effort and alacrity with which they operated. Within the EPIC community, Stayton and Cefkin (2018) have sketched a beautiful portrait of the way in which the caring actions of transit operators – for instance, liaising with local law enforcement, comforting distraught customers – cannot be “formalized into computational procedures” (336); that is, in their very existence and excess, they would seem to defy the “logics of efficiency” underlying many automated systems (225). In each case, these scholars underline the resilience and resistance with which many workers are grappling with, not merely bowing down in submission to, advanced intelligent systems.

This paper adds to these scholars’ small but growing number by drawing on findings from studies that ReD Associates has conducted over the past several years with “ordinary workers” in professions threatened by automation. Our aim is to unpack the ways these workers are resisting competition from new technologies, how they think about or describe

their work, how they actually perform their jobs, and the customers they serve, as we go on to detail in a later section. Underpinning our argument – as well as, we would argue, the orientation of the papers above – is Michel de Certeau’s *The Practice of Everyday Life*. Of course, his work is often credited as having refocused the attention of social scientists on end users, or the consumers of “representations” (read also: goods and services), to study how these users employ them in ways their producers (read: our clients) do not always envision nor intend. Yet more apposite for our immediate concerns, Certeau also gives priority to the ways ordinary people respond to, re-appropriate, and even subvert forces intended to influence or control them, for instance, by introducing ambiguity into everyday acts such as cooking, shopping, or even walking. By making these acts mean something different from what the “producers” or people who shape these activities intend (read: the creators and implementors of advanced technologies), ordinary people (read: workers) have the ability to enact a kind of counter-hegemonic uncertainty or instability (read: the robots have not yet won).

Again, how inevitable is it that full or partially automated technologies will result in widespread job loss? It depends, not only on the technologies themselves, how quickly they develop, by whom and in what ways they are applied – amongst other variables – but also on the workers and the agency that they exercise in resisting or adapting. To be sure, adaption practices that enable workers’ continued survival despite competition from new technologies, we submit, can be seen as effective resistance tactics. Though, it is crucial to note that the resistance we describe here and to follow is against new *technologies*, not against these workers’ employers or partner-suppliers; indeed, frequently the workers we met framed their adaptation tactics as actually helping their employers or suppliers, who rely on their continued existence as a crucial channel for sales, even sometimes alongside or in complement to direct-to-consumer websites. As Howcroft and Taylor (2014) observe, and as we have also noted above, much of the debate around the future of the workforce and automation has been striated with a sense of “technological determinism,” or an assumption that advanced technologies have the ability to transform society as kind of “god from the machine,” with dire and inevitable consequences for humans (1). We intend, in this paper, that a renewed focus on the everyday practices of ordinary workers, and on their “wandering lines” and “errant trajectories,” to quote from Certeau (xviii), will serve at very least to complicate this view and seek, alongside Howcroft, Taylor, and others, to ground theoretical debates in emerging empirical realities. Machines are not – like the Greek gods of old – infallible, nor workers without resilience and resources, as we soon go on to show.

## METHODS

But first, which workers are we talking about? Over the past few years, ReD has conducted several ethnographic studies for private sector clients that enabled our researchers to spend considerable time with professionals in industries being affected by automation, namely with independent insurance agents; pharmaceutical representatives; medical device dealers; and medical device technicians. In the largest and most recent of these studies, several ReD researchers – including two of the authors of this paper – embedded ourselves for a full week inside 6 small-to-mid-size independent insurance agencies in Illinois, Wisconsin, Nevada, Colorado, and Tennessee, conducting in-depth immersions with over 40 agents and customer service representatives, while also speaking to their customers, families,

and community members. For the other three studies, our colleagues traveled to markets across the US, meeting with 8 medical device dealers and 9 pharmaceutical reps, as well as to France, Germany, Brazil and China, where they joined medical device technicians in 13 separate observations. In some cases, these professionals were the “primary respondents” of the studies, or the workers whose attitudes and practices the researchers were most interested to study and observe, while in other instances they served as “secondary respondents,” whose perspectives were critical for helping the researchers map the broader social or industry ecology in which the primary respondents, such as patients being treated for sleep apnea, were situated. To be quite specific, insurance agents served as primary respondents in their respective studies, while the pharmaceutical representatives, medical device dealers and medical device technicians were recruited as secondary respondents.

In meeting with these respondents, both core and secondary, the researchers employed standard ethnographic research methods including participant-observation, semi-structured interviews, as well as exercises to surface respondents’ underlying mental models, for instance of the landscape of insurance providers. To be clear, understanding workers’ responses to automation was the not the explicit focus of any of the studies, which pursued other research objectives determined in collaboration with our clients; though, it did come up frequently as a topic of preoccupation both in the researchers’ notes and in their post-field reflections. In preparing this paper, we have skimmed relevant insights from the surface of our colleagues’ fieldnotes and from our own internal conversations and reframed these to speak to this question of automation and agency. Each of the subsections of our findings chapter to follow opens with a “postcard” from an automation-affected worker: their stories are composites and have been lightly fictionalized and pseudonymized to protect the respondents’ identities.

## **FINDINGS: THE ADAPTATION OF EVERYDAY WORK**

This section is organized into three sub-chapters, each of which demonstrates, using examples from the field, how professionals in automation-affected industries are adapting to compete with automated technologies that threaten their businesses or livelihoods. In particular, the first discusses how workers are evolving how they think about and describe their work to others; the second, how they are adapting their actual work practices; and the third, how they are even, in some cases, moving to serve new kinds of customers. Each sub-chapter also includes a discussion of the challenges these professionals face either in attempting to apply these tactics or as a result of them. To reiterate, we employ Certeau’s term “tactic” to describe these professionals’ techniques of adaptation because it highlights the clear limits of them. Unlike the “strategy” which is methodical and planned, the “tactic” is spontaneous and un-homed, seizing opportunities “on the wing,” as Certeau puts it, without the vantage point to plan a larger attack nor the terrain to consolidate its victories (xix). Methods of adaptation as we go on to describe are clearly tactics in that they are attempts by these workers to “manipulat[e] events in order to turn them into opportunities” (xix). But, as manipulations, they are always-already responses, or defensive measures to hold off the advance of powerful adversaries, which as unpleasant as it may be, are often our clients, the companies making and implementing intelligent technologies.

## **Tactic #1: Adapting how they *define* their work (i.e. identities and values)**

*Paul is a medical device repairman, based in France. His job involves the fairly routine tasks of troubleshooting problems with patients' CPAP machines, used in the treatment of sleep apnea, as well as downloading the data these machines collect about how many apneas patients experience at night and how long they wear the device onto an SD card, for transport back to physicians' offices. But his work also involves many more "softer" functions, such as teaching patients how to properly use the machines and ensuring proper adherence, for instance by lightly admonishing patients who haven't been using them regularly. In an increasingly digital age, in which medical devices may likely soon be able to relay basic information to physicians directly via the internet, without the need for in-home technicians to collect it, Paul nevertheless feels confident of his job security, and has the appropriate language to describe what he does every day: he sees himself and his colleagues as not only technicians but also "engineers, doctors, counsellors, psychologists – everything all in one."*

The process of adapting professional practices starts with changing how workers think about their work and describe it to others – including to ourselves and our colleagues. This is the first and highest-order tactic our researchers observed in that it involves a fundamental redefinition by workers of the "hard" and increasingly "soft" skills their jobs entail and the value these hold for others. Paul, for example, sees – and increasingly presents – himself as providing crucial aspects of patient care, not only troubleshooting problems with technological devices, which may soon be serviced digitally via enhanced Wi-Fi capabilities. To provide some context, many modern medical devices are moving in the direction where, soon, they will likely be able to monitor and troubleshoot themselves. While today, CPAP machines, for example, still require the physical presence of a technician to download data onto an SD card, in the future, these machines will likely be able to transmit data back to physicians' offices autonomously. However, in response to this pressure from automation – among other forces – many technicians are resisting replacement by technology by expanding the tasks they perform beyond "mere" data collection, device repair, and cleaning, into more tasks involving human "soft skills," such as teaching proper device use and even providing much-needed social stimulation for shut-ins. For instance, one technician spent a full 45 minutes talking a patient through how to properly remove and replace her CPAP mask, for instance, if she needed to use the bathroom during the night. In this respect, these professionals resemble more in-home nurses or social workers – "technicians, engineers, doctors, counsellors, psychologist, everything all in one" – rather than specialized industry technicians. To be sure, mere "technician" hardly seems adequate to describe all the myriad responsibilities these workers' jobs now entail.

Devon, an independent insurance agent, similarly sees himself less as an "insurance broker" and more as a "consultant," providing people with all the ingredients they need to run a successful business or household, which includes but is not limited to providing proper risk protection; for instance, Devon also provides workplace safety training tutorials and materials to his commercial customers. "Consultant" – or "strategic insurance consultant," as another agent put it – was a term several independent agents used to explain to us how they were evolving their work to be more valuable to customers beyond (or even as a more accurate description of) what it means to match a customer to a best-fit policy. Other agents preferred "educator," to emphasize their role in explaining the complicated coverages and conditions of a policy; others, "customer advocate," to focus attention on their value as an intermediary who negotiates a fair price with providers and ensures prompt and proper

payouts in the event of a claim. What all these terms have in common is their ability to highlight the uniquely human value these agents add above and beyond a mere website, which cannot, in these agents' eyes, adequately assess an individual's (or business's) complex needs; communicate and clarify complicated information in real-time; nor advocate for customers' interests to ensure their needs are being met, since, with digital websites, the sales channel and the provider are one and the same. In other words, these self-ascribed labels capture a new reality – a new set of “soft” skills that are relevant in these workers' daily practices, and a new set of values that they deliver to customers – which older terms used in their industry, such as “agent,” “broker” or (worst of all) “middleman,” do not.

In some situations, the agents almost seemed liberated by these terms, if also by the ways they were changing their jobs to respond to digital competition, finding a new level of dignity in their work. For instance, one customer service representative, a young business grad recently out of college, seemed genuinely pleased by the possibility that, soon, he would no longer have to spend hours completing quotes for small businesses, many of whom already can or will soon be able to purchase policies through direct-to-business websites. Instead, he would be able to spend his time helping the senior “producers” on his team chase down large accounts – for instance, major mining and construction companies – worth six figures in annual commissions for the agency if they land them. The senior agents in his office felt roughly the same: after years of feeling like “used car salesman,” paper shufflers fighting to command even a little of people's time and respect, they now see themselves as more like the “consultants” or “problem solvers” they have always aspired to be. Rather than clocking long hours in the office filling out forms, they now spend most of their days talking to business owners on-site about their needs, working with underwriters to accurately assess the risks of complicated companies, reviewing existing policies for ways to save their customers money, and even teaming up with agents in other offices to strategize how to win their region's biggest accounts. One principal's eyes beamed as he talked about how an out-of-state agent was flying in to help his agency win a major residential care franchise.

But, again, we do not wish to overstate the benefits of automation, nor to make it sound as if these workers' adaptations to increased competition from digital channels has been easy – nor that their efforts are even over. To some degree, the challenge facing agents is the enduring nature of stereotypes: the ardor and frequency with which these agents and medical technicians talked to our researchers about how *they* saw their work, and what terms *they* used to describe it, is a testament to the fact that they were not yet comfortable that others see it the same way. One agent even wrote a poem defending the virtues of the misunderstood “salesman,” suggesting that he felt others did not share his respect for his profession. “Misrecognition,” to put a label to the professionals' pain, not only “hinders a person's successful relationship to their themselves,” or their self-respect, in the words of Mattias Isser (2013) (with “recognition” being a “a vital human need” to quote from philosopher Charles Taylor [1992]), it also, in our analysis of these workers' situations, threatens their future. That is, if the public does not recognize these workers' new value or contributions, for instance by adopting the new terms agents use to describe their work, then they may not learn to prefer them over digital channels. Notably, the insurance customers we met who seem to find the greatest value in their agents often used terms other than “insurance agent” to describe them, such as “advisor,” “coverage expert,” “community leader,” “advocate,” even “friend.” Conversely, the stubbornness of language, or people's residual use of

“insurance salesman” to describe the profession, in our gloss of these workers’ dilemma, perhaps points to a recalcitrance of thought, in which case the agents stand little chance against the robots. Hence, workers are not only adapting how they think and talk about their work, but also backing up their claims by operating in new ways in the service of new types of customers, as we now go on to explore.

## **Tactic #2: Adapting how they *perform* their work (i.e. everyday practices)**

*Cynthia is a pharmaceutical representative operating out of Florida. In the “good old days,” when she met with clinicians, she’d take them out to a nice lunch, ask about their spouses, kids, and grandkids, maybe finally get around to asking about their contract with suppliers. Easy. But today, she spends a lot of time beforehand reading up on the latest medical discoveries, scrolling health websites and monitoring patient threads. The clinicians she meets now expect her to be an expert not only on her company’s products, but more generally on the disease area. With more competitors and more direct-to-clinician sales channels, Cynthia feels increasing pressure to stand out and prove value to her customers. It’s becoming harder and harder to get face time with doctors and office staff. When she can, she needs to make it worth their time as well as hers.*

As a pharmaceutical representative who has been assigned a specific sales region within southeastern Florida, Cynthia does not have much control over the customers she serves; to an extent, these are determined by her regional sales director. But she does have control over *how* she engages these clinicians, for instance, by spending more time focused on what they need and the value she can provide them, such as information on new treatments and medical discoveries. To linger with this example a little longer, in a more sober modern era, clinicians no longer want (or want to appear to want) fancy perks or boozy lunches; they want to know if you can help them do their job better, for instance, in less time, with improved outcomes, or supported by more effective relationships with patients – ideally all three. Direct-to-clinic channels hold the promise of greater convenience, an “easier” way for clinicians to buy what they need. But only human sales agents can truly help clinicians serve their patients better, for instance, by helping them keep on top of new medical discoveries; see, touch and explore new products first-hand; or even gain insight into patients’ unique challenges and experiences. Hence another healthcare worker, a medical device dealer named Keith, took care to show clinicians how to help patients practice proper device use, for instance, while on vacation and away from their normal routines.

The above is only one example of the way in which professionals are keeping pace with automation-driven change by adapting their work to a) deliver new kinds of value to both customers new and old, as we go on to further discuss below. But professionals are also adapting *how* they perform work in other ways, seeking to deliver this value in b) shorter time frames, and c) with greater flexibility availability and demands on their own time. All three “sub-tactics,” so to speak, can be seen as directly targeted against direct-to-consumer competitors, which a) proffer a value proposition of enhanced efficiency, and b) to that end, complete processes rapidly, heightening consumers’ expectations for faster service, while c) also being available for access 24/7, in part by routing customer queries to fully- or partially-automated customer call centers located in the global south (with service reps who are thus available during work days in northern countries). In what follows, we begin with a deeper discussion of how professionals are attempting to deliver new types of value beyond, and in opposition to, a logic of convenience, and then move on to analyzing the other two sub-

tactics – shorter time frames and greater availability – closing with a discussion of the challenges all three pose.

*Delivering new kinds of value...*

As an insurance agent in a small midwestern town, Devon is trying to stand out with both his personal and (small) commercial lines customers by doing more than “just” selling them an insurance policy. For instance, every morning he scours the internet for interesting articles he can share, such as “10 things you need to know about having a teenager drive,” or “how to winterize your home,” hoping customers will see him as a broader source of advice beyond just “what insurance policy should I buy?”. He provides his (small) commercial lines customers with materials to support their broader business, such as safety trainings, manuals, and liability release forms, and even has ambitions to start producing videos that will help small business owners not only protect, but also promote their company’s assets. Moreover, whenever he visits a client of any kind, he asks them what else they need help with, connecting them to another professional, such as a local plumber or accountant, even if their problem is unrelated to insurance. In these ways, Devon is finding new means of proving value to his customers above and beyond simply selling them a basic insurance policy, something which, increasingly, direct-to-consumer websites are also able to do. While it is possible to see Devon’s actions as intended to differentiate him from both human and digital competitors, they feel particularly calibrated to combat a digital adversary, which (so far) cannot give advice beyond “buy this policy,” nor provide additional resources and connections to customers. Devon indeed told researchers that he sees his customers as increasingly wanting to “do everything online,” cognizant of rising competition from direct-to-consumer channels; within this context, it is possible to interpret his actions as adaptation tactics.

To be sure, Devon’s leverage not only of his human knowledge and expertise, but also of his unique social relationships seems especially crafted to differentiate him from non-human competitors. Can Geico.com also connect you to a chartered accountant, specifically one that you trust with your family’s 100-year-old business? Several scholars, including eminent trust theorist, Russell Hardin, have observed that increasing distrust in our modern society may be due to the fact that many relationships are now purely digital and not embedded in a “rich enough network of broader relations to ground enforcement of any norms” (2006, 8). That is, the provider behind a large direct-to-consumer website may have little incentive to provide any one customer with impeccable service (though many unhappy customers over the long term is likely to significantly damage their reputation), whereas a local agent like Devon has “thick connections” to many clients at once, which aligns their interests with his. That is, if he were to fail even one of his customers, many of his other customers would likely find out, affecting his business. As another agent put it, her customers are the people she encounters in the grocery store each day; “they know my mom, they know [the agency principal] and [the agency’s principal’s] mom.” This network of “thick connections,” and its resulting accountability then gives Devon the credibility he needs to recommend local help, e.g. accountants, lawyers, as well as to find and to recommend insurance policies.

Many of the insurance agents our researchers met, as well as the pharmaceutical representatives and device dealers, indeed saw enhanced credibility or trust – built up over



decades of loyally serving customers and through active involvement in their local community, for instance as church aldermen or school council committee members – as one of their chief advantages over digital competitors. Their adaptation tactic here, then, is not so much altering professional practices, but rather continuing to behave in the same consistent, customer-focused ways whilst ensuring their customers become more aware of the superior value of a human salesperson over digital channels; it is, in other words, possible to see this as an intensification, and greater amplification of existing practices rather than the emergence of new ones. Can Geico.com really get you a quote within 15 min? Not a good one, several agents told our researchers, in more or less the same terms. Fifteen minutes filling out a superficial questionnaire is likely to produce a patchy policy that leaves many of your assets at risk. Whereas an agent who is also the coach of your daughter's basketball team – who sits three rows behind you in church every Sunday morning – will take her time pouring over every detail to make sure your best interests, and hers, are being looked after. After all, she has multiple incentives to honor your trust: her whole business, not to mention her broader standing in the community, depends on it.

*...in shorter time frames...*

The sub-tactic of delivering – and highlighting – unique kinds of value above and beyond convenience is really about advancing a different kind of logic that goes beyond mere efficiency and places the spotlight on higher human values such as trusted advice and social connections. In other words, it attempts to shift the standards by which the industry operates to ones that play to agents' uniquely human strengths. Yet, in also trying to find ways to reduce the time they spend on specific tasks, some professionals are also molding their practices to fit the efficiency logics of digital systems rather than rejecting them altogether. Melissa, like many of the agents our researchers met, was acutely aware of her clients' increasing expectations for faster service and working harder to meet these. In a world where customers can get a quote from Geico.com in 15 minutes, not to mention hail an Uber or download a movie in two, Melissa feels she need to return an answer to customers "within at least 24 hours." Fortunately, with the conglomerate rating system her agency has purchased, Melissa can fill out a single form with her customer's information and receive initial quotes from several providers within a few minutes. This then gives her the time she needs to "refine" her sense of the advantages and disadvantages of each of the top quotes (which she chooses based on fit with her customer's needs, not purely on price), and prepare a polished pitch for the customer, thereby demonstrating her superior quality of service and advice especially over a simple, price-focused algorithm.

This tension, between needing to get back to the customer faster whilst also demonstrating superior service has led to some surprising innovations among workers. For instance, one enterprising agent, at an agency that did not provide access to a conglomerate rating system, frequently used providers' direct-to-consumer websites to generate a ballpark estimate for quotes: would they even be within the price range of her customers? This then allowed her, like Melissa, to rule out bad-match providers quickly and get back to her customer faster. This is perhaps the best example of a "errant trajectory," to riff on Certeau, in our data, or the use of a technology by a worker in a way that its producers likely did not expect nor intend. To provide some context for this tactic, many insurance providers are now pursuing multi-channel strategies, creating websites that sell their policies directly to

customers, while also continuing to contract with independent agents who sell their policies (among other providers') while taking a cut in commission. Yet multi-channel does not usually mean, in this particular sense, cross-channel, with one channel cannibalizing the sales of another by turning the competition into a tool to improve response times with customers, as this agent has done.

*...with greater flexibility and availability*

Increasingly "frictionless" digital encounters, both within the professionals' fields and outside them, are not only raising consumers' expectations for speed, but also for availability. This leads us now, briefly, to the third sub-tactic, which is adapting professional practices to provide greater flexibility to customers. Digital websites, and the partially automated customer call centers that support them, are now open 24/7. Agents, among other professionals, feel they also have to be. One agency overhauled its phone operating system so that instead of checking their voicemails intermittently throughout the day, the agents now automatically receive a text message when they have a new voicemail from a customer, even if they are at home or otherwise out of the office. And increasingly, their agency owner expected them to listen to, and even answer these voicemails. Another agency reshuffled its pool of customer service representatives so that, instead of waiting for "their" CSR to get back from a break, any customer could be served immediately by any CSR, using their comprehensive file in the customer relationship management system. In this way, the agency aimed to ensure that a customer could always promptly reach an agent if they had questions about a quote or existing policy. Devon, mentioned earlier, even devised a way to make himself available for sales pitches, not only inquiries after hours, by filming himself explaining coverage options. His millennial customers, he explained, hate taking time out of their workday to meet him in person. So now they don't have to. They can simply open his video from an email and learn all about their coverage, texting him if they have questions or have decided on a particular policy. These videos are almost as easy as logging onto a website, but much more information-rich and personable: they can still "see my face...laugh at my jokes," as Devon relates.

Of course, competing with automated websites that have no need to sleep, eat, or go home to their families is not easy, leading us now into a discussion of the unmet needs and challenges of each of these sub-tactics. To continue in order, it can be difficult, firstly, when delivering new kinds of value, to figure out what goods or services customers actually need or find useful. Devon's scattershot "fixer" approach, spending his time surfing the internet, learning how to make marketing videos on his iPhone, and building a portfolio of local repairmen to recommend, is not likely to succeed, as even he is well aware. What he really needs is insight into his customer's core problems – particularly related to risk, an insurance agent's core expertise – so that he can develop unique solutions that help him stand out from his competitors, both digital and non-. But few professionals have the resources, time, or even skill to fully comprehend their customers' problems, nor may their customers find it straightforward to articulate to them what it is they actually need. Hence, in a sense, what these professionals need is an applied ethnographer to conduct immersions with their clients in order to surface a set of unmet needs; by addressing these needs, they could then make themselves more valuable and less easily replaceable. Unfortunately for Devon, as for many of his peers, these services are largely beyond his financial means.

What about the second sub-tactic? What challenges are professionals, specifically agents, encountering in, or as a result of, their efforts to respond to customers faster? The first and most obvious challenge here is mental and physical exhaustion, as these agents try to complete the same work in less time, often while also providing higher levels of service to their customers. But practically speaking, as these professionals told and showed our researchers who looked over their shoulders as they entered customer information into the quoting systems, they need more automated tools, especially for data entry. In other words, these agents wanted more auto-fill features in their existing quoting software systems as well as entirely new tools altogether, such as a conglomerate rating system for small businesses, which would help to reduce the time they spend completing quotes and free up time for demonstrating their uniquely human value, for instance by creating more “refined” or detailed quotes for customers, or by showing empathetic care – one of the agents even sent her customers wedding anniversary cards. This is, we think, one of the most provoking findings from our research, as it relates to the question of how new technologies are impacting professionals’ daily work: automation in one area of these professionals’ industry (e.g. sales) heightened demand for enhanced automation tools in another (e.g. data entry). Fortunately for the agents, some of these tools, such as advanced customer relationship management systems with auto-fill features, already exist; it’s merely a matter of making them more widely available. Others, such as a conglomerate rater for (small) businesses, are (allegedly) in development.

The consequences of the *third* sub-tactic, or challenges related to the ways in which professionals are making themselves more available to customers, are not so easily addressed with existing technologies – or even any kind of technology. To put it simply, how do you help professionals set better work-life boundaries? Several scholars, including Howcroft and Taylor (2014), have also drawn compelling attention to professionals’ struggle to contain work responsibilities in a digital age when connected technologies make it possible for anyone to be reached any time; Ens and colleagues (2018), too, show how the very connected technologies that have enabled more professionals, such as “digital nomads,” to work remotely also make it harder for them to “feel competent managing their tasks and time” (5). Still, it’s difficult to understand what kind of intervention would be helpful here; the change that is required seems much more systemic and cultural. Our firm recently conducted research for a telecommunications company in Central America and found that, generalizing slightly, it is not uncommon there to reply – or expect to receive a reply – until at least a day after an initial message was sent. In part, this attitude is a result of intermittent connectivity in the region – service outages frequently prevent people from replying promptly, which has helped to create a culture where delays are accepted, even the norm. Nonetheless, this seems the kind of cultural consensus – almost collusion – that is required in order to free these agents from the increasing pressure they feel to compete with digital websites by making themselves available at all hours, a losing battle in many respects.

### **Tactic #3: Adapting *who* they serve (i.e. customer composition)**

*Melissa is an insurance agent, working in a mid-size agency in Idaho. She quit her job at a high-end hotel a few years ago, when the wealthy customers she had helped to organize events for became excessively demanding, keeping her at work at all hours. In moving to insurance, Melissa hoped to find a more relaxed environment. But these days, at her agency, she finds herself serving more and more of that same type of*

*wealthy, discerning customer. Often, lately, Melissa actually (politely) hangs up the phone on young couples who want a policy for their first home, or college students who need a basic auto coverage. She knows that, even if she spends time talking to these value-minded customers, they will likely end up going online to buy a policy directly from a provider anyway. She “just can’t” waste her efforts on them. But higher-end customers more often prefer, and require, her advice: their needs are much too complicated for an online form and algorithm. She is slightly nervous about this shift in her customer base, but also confident: after all, she has successfully served this customer profile before.*

Many businesses serve more than one type of customer. Some make this diversity explicit with a customer segmentation; a few develop unique strategies for serving different customer segments, for instance, with targeted products or promotions; others may even decide to specialize in a particular subset of customers, seeking greater efficiency and higher returns, especially when threatened by increasing competition in their industry. Melissa is no different. When faced with increased competition from direct-to-consumer websites, she chose to focus her efforts on a specific niche of her customer base: high-end customers with many different assets to protect, who cannot be so easily served by a digital distributor. We saw this as a common tactic among the insurance agents, who have some control not only over the providers they contract with, but also the customers they serve, partly as result of their freedom to choose which products they sell. For instance, another agency our researchers visited was in the process of shifting its product portfolio, customer service experience, as well as marketing outreach to better attract commercial, rather than personal property and casualty customers. Currently, most direct-to-consumer websites sell only simple personal lines insurance to individuals or families, that is, basic auto, home, or contents coverage. Small businesses may, soon, be able to buy their insurance online, yet many experts predict very large or complex businesses, such as high-risk trucking outfits, will continue requiring the help of a human agent, in collaboration with an underwriter, to purchase insurance, perhaps indefinitely. Hence the agency was in the process of pursuing commercial businesses both large and small as new customers, though, the rapid pace of automation means that they will likely have to shift their tactics yet again as soon as websites for small businesses become available on the market – as mentioned above, there are strikingly few ways for workers to adapt permanently to, or consolidate their gains against, technological competitors.

The quest to find a lee in the rapids of digital disruption also explains the tactics of another agency owner, Barb, who was in the process of evolving her business to sell new kinds of insurance products beyond property and casualty insurance, such as life and health, when we met her; selling different kinds of products is a key way that agents can reach new customer groups. Although competing with online disrupters by attracting a new group of customers was not an explicit reason Barb gave for diversifying her product line, it is easy to interpret her actions as instigated by the need to differentiate not only from human competitors but particular from digital ones. For instance, the act of buying life insurance brings up many customers’ fears around death, as Barb told us; hence it requires a gentle touch and deep understanding of human psychology to successfully sell these kinds of policies – warm, human traits that a transactional digital “agent” or direct-to-consumer website may struggle to embody. Moreover, health insurance, at least in the US, is often provided through employers, who require large teams of agents to negotiate discounts on policies with providers, explain the specific terms of these policies to their employees, and be available for questions from these employees at all hours, preferably in person. To be sure,

our researchers stood by as Barb's agents fielded calls, distributed materials, and prepped for coverage presentations at the nearby offices of the city government, one of the agency's healthcare clients. In these ways, that is by selling new products – life and health insurance – to new types of customers, Barb had clearly found ways of playing to the strengths of her human agents with whom digital channels could not easily compete.

Of course, when it comes to holding off digital competition by serving new customer groups, insurance agents may have it easier than workers in other industries because they have the ability to sell a range of products sought by a variety of customers who operate in different ways relative to new technologies. That is, again, the act of buying a policy to provide for your loved ones in the possible event of your death carries a different emotional valence from buying a simple auto insurance policy. It requires calculating different sums – not, “how much is my car worth” but rather “how much will my family need to keep going day-to-day?” – as well as considering alternative hypotheticals – not, “how likely is it that windshield will be damaged by hail this summer?” but instead “how likely is it that I'm going to die before my loved ones?” These are much more agonizing, less straightforward questions. Customers' reluctance to grapple with these questions on their own, without the help of a trusted advisor, then creates an opening for human agents who are able to help them almost as a pastor or therapist – one of Barb's star workers, Melinda, in fact cited her degree in psychology as fundamental to her success as an agent. Whereas, in other industries, where products and sales process are more standardized and standardly transactional (e.g. consumer goods), retail workers may continue to struggle to differentiate themselves from online platforms (see: the rise of Amazon).

Still, the tactic of remaining profitable by pursuing new customers – even for insurance agents – is not without its challenges. In particular we saw that these workers struggle to a) reach and build connections with new customer groups; b) develop expertise in the new kinds of products these customers seek; c) learn the right kinds of skills for attracting and serving new customers, both before and after the purchase; and d) hire skilled staff to help them win new, less familiar customer groups. Barb indeed grappled with this final challenge until Melissa fortuitously quit her job at a large healthcare provider and agreed to join her small agency. Melissa, profiled above, was among the more fortunate agents in our sample: she was able to a) build connections with new, higher-net-worth customers through her colleagues in commercial lines, who referred her to their wealthy business owners; b) develop expertise in new, more complicated products with the assistance of her agency principal and mentor, Elaine; c) gain the skills for serving high-end customers by drawing on her past experience in hospitality; and d) get access to qualified service representatives and junior agents through the national agency network her agency belonged to, which kept an up-to-date talent pool. But many of the other agents we met lacked these advantages, raising questions of their likelihood of successfully adapting to automation, at least without help from others, such as the providers who (still) contract with them to sell their policies.

## CONCLUSION

Once more, to what extent will increasing automation lead to widespread unemployment? To revise our previous answer: it depends, not only on the workers themselves, and the ways they are evolving their daily work as we have shown in the above, but also on the organizations who have a stake in these professionals' futures, including

corporate suppliers and vendors, non-profit foundations, even governments. All of these can play a role in helping workers transition into a more digitized economy. For instance, in our work with our private sector clients for these studies, we helped them develop solutions to some of the challenges professionals face, such as better ways for pharmaceutical representatives and medical device dealers to demonstrate value to clinicians, as well as new training resources for insurance agents, to help them become more knowledgeable in the complicated insurance products their new groups of customers seek, among others. Of course, there were a limited number of interventions our clients were *able* to make, given questions of costs and feasibility, or felt that it was in their *interest* to make, given the core focus of the studies. Still, it is easy to envision other potential client-partners or applications for this kind of research, such as governments who wish to come to the aid of regional workers; technology companies who want to offset or mitigate the impact of their products, not only develop more competitive ones<sup>1</sup>; or even large corporations undergoing digital transformations, who want to understand how workers on the frontlines are being affected by this process and, based on this, develop new tools and solutions to ease their transition into novel ways of working.

As our research with four “endangered” professionals has shown, workers are on the frontlines of disruption in their industry, possessing firsthand knowledge and expertise. More employers and organizations should find ways of tapping into this insight as a valuable resource. But, first, they would do well to acknowledge workers *as agents* with a particular vision for how they want to conduct their work and which specific methods to employ to carry it out, even if they occasionally require external assistance. Hence, we end with a call to recognize agents *as agents*, as ironic as this may sound, and for more efforts to partner with, not parent, workers as they strive to adapt their everyday practices in an increasingly automated age.

**Tamara Moellenberg** is a Senior Consultant at ReD Associates, based in New York City.

**Morgan Ramsey-Elliot** is a Partner at ReD Associates, based in New York City.

**Claire Straty** is a Manager at ReD Associates, based in New York City.

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1. See, for instance, Sandra Upson (2018) on how some technology firms are investing in retraining the workers their technologies have displaced, an effort which we argue could be better guided by ethnographic research.

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## Case Studies Session

# User Agency in UX Research

Curator: Eva Caspary (Insight Culture)

The papers in this session all concern how we produce automated systems to support and assist humans without infringing on their sense of agency—what is the right balance?

Our authors investigate human agency in the context of driverless car concepts, how chatbots can support human agency in customer service centers, the role of AI assistance in the context of professional knowledge work, the importance of maintaining customer agency for a successful online travel booking process, how to preserve and enhance the advantage of human agency over robots on future missions to Mars.

We live in an era where exponential development of AI capabilities will slingshot into unpredictable futures and where anxious narratives of humans being replaced by robots, divested of all agency, exist. These narratives prioritize the need to conceptualize and design automated systems that consider humans in the equation as agency not only corresponds to fundamental human needs such as certainty, significance, and growth but also harvests superior results in specific areas of activities when compared to automation.

The papers detail the differentiation between “low-level”, “peripheral” or “procedural” work, which invites automation and “high-level”, “core” or “exploration” activities for which humans demand and need to stay in command and control to preserve or even enhance human agency. The session also explores the ambiguities of automation anthropomorphism and how it hinders or enables agency.

In the German language “agency” translates into not one definition but three. Indeed, where agency can exist as an abstract term typical for context-based languages, German as a very explicit language calls for precision. Three terms, which, when translated literally are quite revealing of agency’s multidimensional virtues:

**Handlungsfähigkeit** – the ability to act - meaning that we have **acquired a (mental and/or physical) condition** that allows us to act, we are able to connect meaning with behavior.

**Handlungsbefähigung** – the enablement to act - meaning that we are **given the (internal and/or external) resources** to act successfully

**Handlungsmächtigkeit** – the power to act – meaning that we are **masters** to act, we are under control, have legitimation and freedom to decide, are potent  
All three terms convey different agency meanings, which are prevalent in the papers that follow—enjoy the discovery.

## My AI versus the Company AI

### How Knowledge Workers Conceptualize Forms of AI Assistance in the Workplace

NANNA SANDBERG, *Stripe Partners*

TOM HOY, *Stripe Partners*

MARTIN ORTLIEB, *Google*

*GSuite is changing the nature of Knowledge Work across 5 million businesses through AI-powered assistance. To ensure that this evolution reflects the aspirations and priorities of workers, Google and Stripe Partners conducted a multi-national ethnography of Knowledge Workers covering a range of industries. We identified that workers distinguish between 'Core' and 'Peripheral' work: the work they are paid to do and identify with, and the work that does not contribute to their success or happiness. Workers want assistance to enhance Core work and remove Peripheral work, nuanced across a spectrum of support. This framework and taxonomy has been adopted by teams at Google to inform strategic decisions on how AI is integrated by GSuite. New features are being implemented within Gmail, Slides, Docs and Sheets that bring these principles to life in the user experience.*

## INTRODUCTION

AI and automation are often spoken of as threats to human agency due to their potential to take over activities that humans are currently doing at work. In mainstream media narratives (e.g. Forbes, 2018) AI-based technologies are presented as something that is either present (and takes over) or absent (leaving humans in charge). This creates a false dichotomy and unhelpful distinction between the two states.

This paper is based on joint research conducted by Google and Stripe Partners in 2018. The objective of the research was to investigate the role of assistance, as idea and practice, in professional knowledge work. Data for this paper is derived from ethnographic interviews and workplace participant observation in several European countries.

Our research revealed the relationship between AI and workers is more nuanced than is often portrayed. We found that knowledge workers do not fear AI in of itself, but have a fine-tuned sense of how they want to perceive and experience its role in their work. These distinctions can vary between workers, driven by personal ideas of status, identity and professional responsibility.

The recommendations and insights informed both Google's short term product strategy for G-Suite, as well as providing a number of foundational frameworks and common taxonomies that have been adopted across the organisation from leadership to different product teams.

## OVERVIEW OF PROJECT

### Research Context

Recent reports, (e.g. Davis et al., 2018) illustrate how the world of work is changing because of AI. Some jobs are being automated, while others are evolving. There are many technologies and services that are driving this shift. GSuite has been adopted by over 5 million businesses around the world, and the AI-driven features it integrates make it an important actor in this context.

Strategically, GSuite is focused on supporting the evolution of human knowledge work rather than automating it. GSuite's stated mission is to elevate human accomplishment through machine learning augmented tools in the workplace. The objective is to help people to focus on their most important tasks, and, in doing so, enable companies to thrive.

GSuite is poised for the next wave of change in collaborative work. Individual contribution is almost always just one piece of a puzzle within complex knowledge workflows. The Google research team were looking to enable this collaboration not just within GSuite's products, but across the products they use everyday.

Google believes that people should be able to collaborate in context, with Machine Learning and AI features built-in. Consequently, these capabilities should augment how people at work collaborate. This must be done responsibly and to the benefit of workers and businesses. Hence a focus on such tools is an opportunity of investment in Google's customer's employees and their company's culture. Google also is aware that great care need to be taken when designing with AI Principles (<https://ai.google/principles/>) and Responsible AI Practices (<https://ai.google/responsibilities/responsible-ai-practices/>)

### Research Objectives

As researchers we realised we needed to dig deeper than these strategic principles to translate this vision of AI-powered work from the perspective of workers. So we embarked on a program to understand the world of knowledge workers, exploring questions such as:

- what tasks in their everyday work do they value, which ones do they loath?
- which activities in their roles do they believe they give most value to their employers?
- what are the opportunities for G-Suite to provide Creative Assistance during the process of content creation: what types of work would people most appreciate having replaced or helped by AI?

Importantly, by taking a 'bottom-up' perspective the project sought to provide the team with an understanding of what assistance workers need today. This focus meant that resultant outcomes are designed to support existing working practices rather than replace them. Our research focus was therefore on incremental improvements to existing working practices, rather than analysing workers systematically to identify opportunities to fundamentally change or remove roles.

## Key Outcomes

The main contribution of the project within Google has been twofold (see more detail in ‘Implications and Impact’ section below)

1. *Embedding a new set of taxonomies and frameworks that inform AI-related decision making throughout the GSuite organization*

The frameworks outlined in this case study have been socialised across both the executive and product layers of the organisation, helping teams prioritise and develop strategies for integrating AI into their products

2. *Driving product innovation within specific GSuite teams*

Many product teams at GSuite (Gmail, Calender, Sheets, Docs) have now adopted these frameworks to inspire and guide how they integrate AI into their products, with many examples of new features already live

## Methodology: Challenges to Address

With a research brief to ‘explore attitudes to AI-assistance in professional knowledge work’ there was a significant methodological challenge for the research team in how to cover this topic that moved beyond existing tropes (both positive and negative) driven by the public discourse on AI and its potential role for work in the future. Researching technology that is not yet in (widespread) use is always a challenge as there is often no obvious existing behaviour to look at or existing preferences to discuss and explore. How is this possible to explore ethnographically? The problem is exacerbated because research participants could struggle to distinguish between prominent media-driven perceptions and the reality of their own behaviour.

Furthermore, knowledge work is a nebulous concept with ambiguous boundaries (Cross, Taylor & Zehner, 2018). Attempting to cover it in one research project is exceedingly difficult. It is broad in the range of people who do it (from secretaries to lawyers to nuclear scientists), in the range of activities it describes, in the range of (types of) organizations it takes place in and in the range of meanings attached to it. Academic research into knowledge work is typically either very abstract, looking to draw out general principles of knowledge work (Davenport & Prusak. 1998) or more narrow and not even attempting to say anything about the topic of knowledge work as a whole, but rather say something relevant about a specific type of work, workers or places. The challenge for this research was in doing ethnographically grounded research that would lead to insights with implications across the entire spectrum of knowledge work.

## OUR RESEARCH APPROACH

### Terms of Reference

‘Knowledge Work’ was a term coined by Peter Drucker (Drucker, 1969). As commonly understood, it describes the growing cohort of workers who “think for a living”. Knowledge Work is therefore a broad category! Our study encompassed a range of knowledge workers: from designers to accountants to administrators to engineers to brand strategists. Nearly all our participants worked for large organizations and were primarily based in corporate HQs rather than remote working (although some remote working practices were observed). Within this, there was a mix of levels. We spoke to everyone from senior leaders to support staff. Everyone we spoke to existed within a wider team with whom they produced work collaboratively, although the frequency and intensity of collaboration with co-workers did vary across our sample.

‘Creative Assistance’ is a term used within Google to describe forms of AI that support knowledge workers within the GSuite product experience. This includes technologies that have been launched in the last 24 months such as Smart Compose in GMail (<https://support.google.com/mail/answer/9116836?co=GENIE.Platform%3DDesktop&hl=en>) and Suggested Layouts in Slides ([https://support.google.com/docs/answer/7130307?visit\\_id=637038105256693940-2801069891&p=suggest\\_layouts&hl=en&rd=1](https://support.google.com/docs/answer/7130307?visit_id=637038105256693940-2801069891&p=suggest_layouts&hl=en&rd=1))

### Researching Knowledge Work

Highly skilled knowledge work is a complex process constituted by small tasks executed by individuals. These add up to larger tasks and workflows executed by multiple individuals, which lead toward desired outcomes. Researching such work requires mixed approaches in order to explore its complexity. For this research it entailed a combination of research with individuals and organizations.

#### *Individual in-depth interviews*

The researchers conducted a dozen in-depth ethnographic interviews with knowledge workers in the United Kingdom and Switzerland working across industries such as financial services, marketing, design and manufacturing among others. The individual perspective pursued in the interviews allowed the researchers to explore personal narratives around worklife, past, present and future. It also allowed for deep dives into actual work-flows with each respondent, which were essential in developing our framework for assistance, which will be discussed later in this paper.

#### *Organizational ethnographies*

To complement the individual perspective from the in-depth interviews the research also consisted of participant observation in three companies in Switzerland, an apparel

manufacturer and a manufacturing services company, and in France, a gas company. By attending meetings, speaking to employees and colleagues working together, the organizational part of the research complemented the individual interviews in providing the organizational perspective of work. The organizational perspective lays both in the collective and collaborative work process that most knowledge work happens within and is constituted by, but also shows the role of tools and formal structures in how work is conducted. Seeing the formal structures of work within an organization also avoided over-emphasising the role of individual agency in doing work. The tensions that individual vs collaborative working modes surface in relation to personal assistance are discussed below.

### **Focusing on ‘Assistance’ as a Way into Exploring AI**

As discussed above, AI is a topic regularly discussed in mass media, often communicating strong claims about its potential role in changing the future of work. Against the background of such claims, having a conversation with a respondent about their own job and the potential role of AI in it risks becoming about public narratives of AI rather than the respondent’s own working reality.

To avoid this trap the research was framed around the concept of ‘assistance’ in the workplace. Assistance was consciously framed as tech-neutral and machine-human-neutral, i.e. assistance could be provided by a person or some form of technology, AI-enabled or not.

In essence, we explored instances of when people received some form help and support, and what kind of help and support they wanted or didn’t want in the future. This enabled the researchers to discuss work with respondents and draw out nuances around work the respondent does themselves, work where they get assistance from other individuals and work where they get assistance from technology. Importantly, it also allowed for discussing when and where respondents would like more assistance, from either another person or technology.

However, from an ethical perspective we did not want to obscure the nature of our enquiry. So at the end of each interview we made the idea of machine assistance more explicit and encouraged a full and frank discussion about it. These discussions were informed by the previous exploration of assistance, meaning they were rooted in the reality of the individual’s work rather than existing media narratives.

### **Mapping Workflows to Reveal the Reality of Everyday Work**

Beside avoiding existing narratives overly influencing the research, there was also the difficulty of capturing the complexity of knowledge work with the limited time and methods at the disposal of the research team.

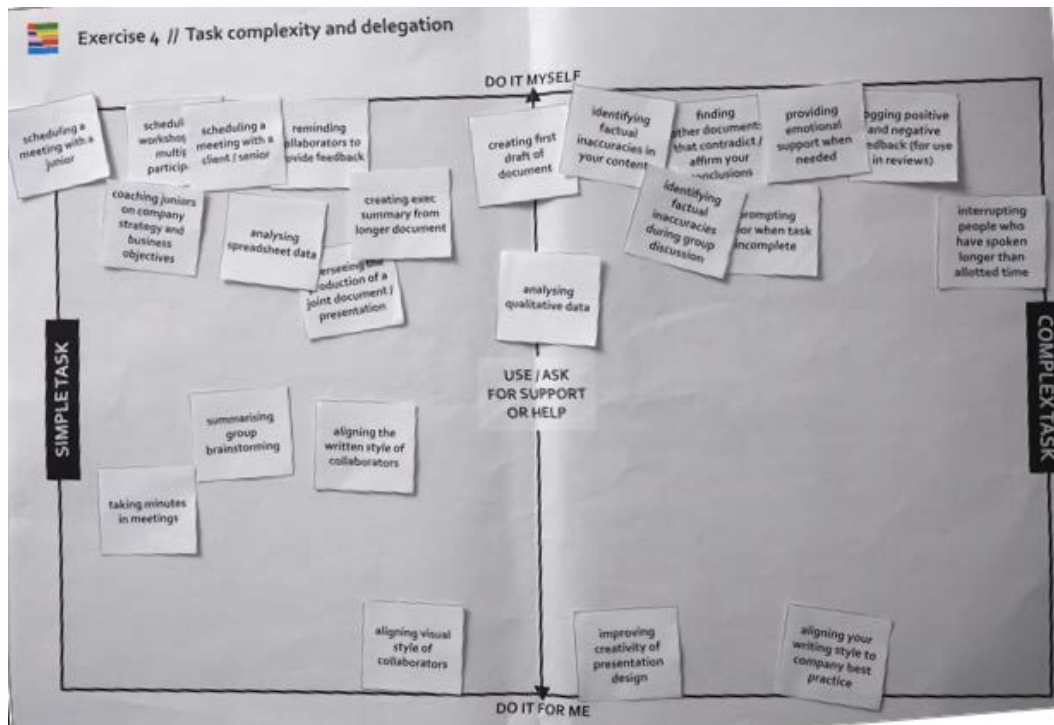


Figure 1. participant places tasks on a spectrum of support preference and perceived complexity (© Google, used with permission.)

Most knowledge workers spend 40+ hours every week doing work. How is it possible capture anything tangible from such a mass of data? And how is it possible capture something beyond a superficial view of an individual's work? The solution was to dig into specific projects, processes and workflow with each respondent. By taking a significant, ongoing task the respondent was currently involved in, the researcher could explore the various workflows involved and furthermore the smaller constituent tasks making up the workflow. The result at the end of the research was that the research team could map a number of very detailed workflows across time and tools used.

For example Perry, a financial analyst based in Zurich, was responsible for a routine but multi-layered piece of work every week: updating a financial forecast for the C-Suite in his organisation. To do this he required sales data from multiple co-workers spread across Africa to be delivered on time and in the right format. Every week Perry needed to manage and fix the same inconsistencies before he could generate the forecast. To him this was a waste of time. In the framework we subsequently developed, this is 'Peripheral' work.

## CORE AND PERIPHERAL WORK

When observing and exploring everyday work a clear pattern emerged across all industries and roles. Workers days were split between a variety of activities, some of which

they talked to as being core to their job, but the majority of which they talked about as peripheral.

Tina, a researcher and analyst for a finance firm, represents a typical story from the study. A typical day consisted of three hours spent on ‘real work’ and five hours on tasks she regarded as peripheral.

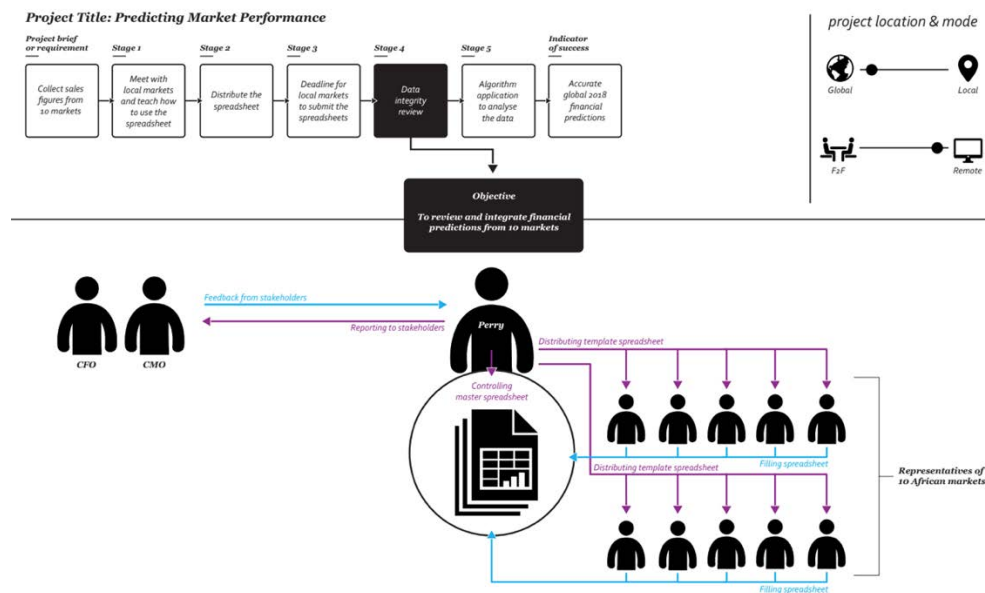


Figure 2. Workflow mapping of Perry a financial analyst. (© Google, used with permission.).

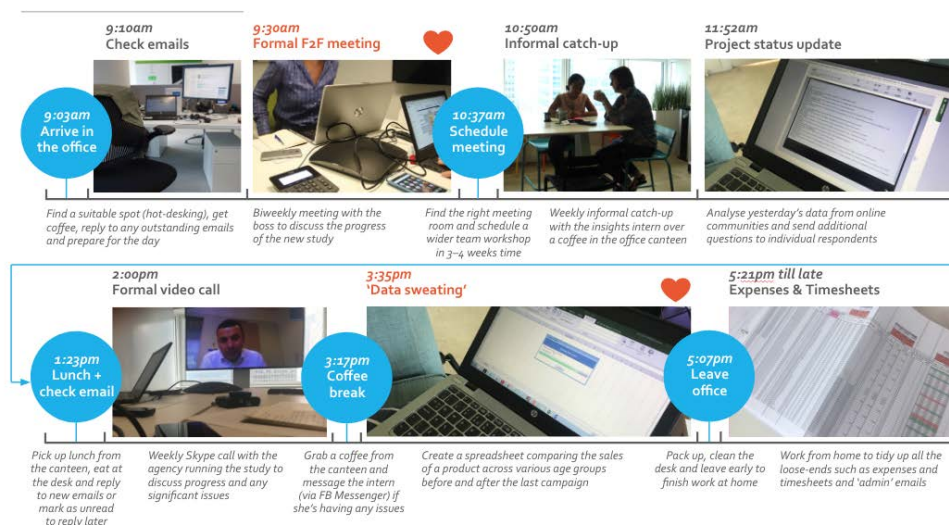


Figure 3. Tina spends more time on Peripheral work than Core work. (© Google, used with permission.).



## Defining Core Work

“As a category manager I’m supposed to have a vision of where the category is going and what the trends are”

Louise, Category Manager, global CPG firm

‘Real work’ is the work that is core to one’s job role, aspects of which are also core to one’s professional identity. Core work was described as the tasks and activities that directly contribute to achieving the aims of one’s job role. It is those activities that feel meaningful, that are part of your job description and that you get rewarded for. In other words, they are recognized by the employer as core to your role: it is what you are ostensibly employed to do.

Core work is often also core to your personal skill set and your professional identity, at least to the extent that you are in a job that matches your skills and experience. Thus, core work is not only core to the employer and job role, but it is also core to the individual worker as those tasks and activities that use your particular skills, where you get to use your skills and experience and where you can develop further within your professional field. As such core work is also central to the worker’s professional identity and career trajectory. During interviews it was often the tasks that individual workers wanted to focus more on and do more of.

## Defining Peripheral Work

“My role is about dealing with people... but every time I travel I have to waste 2 hours filling in my expenses”

Alan, Project Manager, Gas Company

A large proportion of work that is only indirectly contributing to achieving the goals of one’s job. When asked respondents estimated the size of this more peripheral work to between 30% and 60% of their workday. While these tasks and activities only peripherally contribute to work goals, they are nevertheless important tasks that need to be done correctly. The risk of avoiding or delegating peripheral work can be high.

One recurring example of peripheral work was recording and reporting travel expenses. It does not contribute to the job goals of the person travelling, but is necessary for the accounting within the organization as a whole.

It also highlights a common characteristic of peripheral work, namely that what is peripheral to one person’s job is central to someone else’s job. In the case of travel expenses they are likely a core part of the job of someone in the accounting department of the organization.

Peripheral work, as tasks that do not directly contribute to your job goals, is also work you do not get rewarded for and rarely use your particular professional skills to do.

## Davenport's Model of Knowledge Work

Business professor Thomas Davenport is one of the leading theorists of Knowledge Work and his “classification structure for knowledge-intensive processes” (Davenport, 2005) maps broadly to our conception of core and peripheral work.

In broad terms core work maps to Davenport's concept of “interpretation / judgement” work, while peripheral work reflects “routine” work. However, Davenport's model is a more accurate mapping of knowledge workers aspirations than the reality of their core work. Often key responsibilities were routine and, in a technical sense, were therefore core. However, most workers we spoke to intended to increase the proportion of “interpretation / judgement” work that was core to their job. This became an important factor in defining how workers wanted to experience assistance at work.

### A classification structure for knowledge-intensive processes

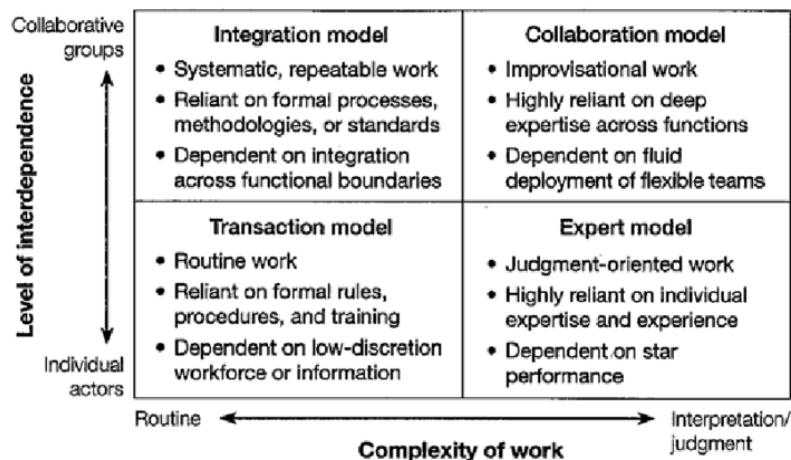


Figure 4. Davenport's model of Knowledge Work (Davenport, 2005)

Using Davenport's model we developed a framework which helped us to categorise the different forms of work we were observing and how it is experienced by workers. This, in turn, mapped to our core-peripheral model, with routine work generally mapping to routine work and complex work mapping to core - with some important exceptions which related to job role.

We then identified common pain-points using this model which helped Google teams to apply the model of assistance detailed in the next section.

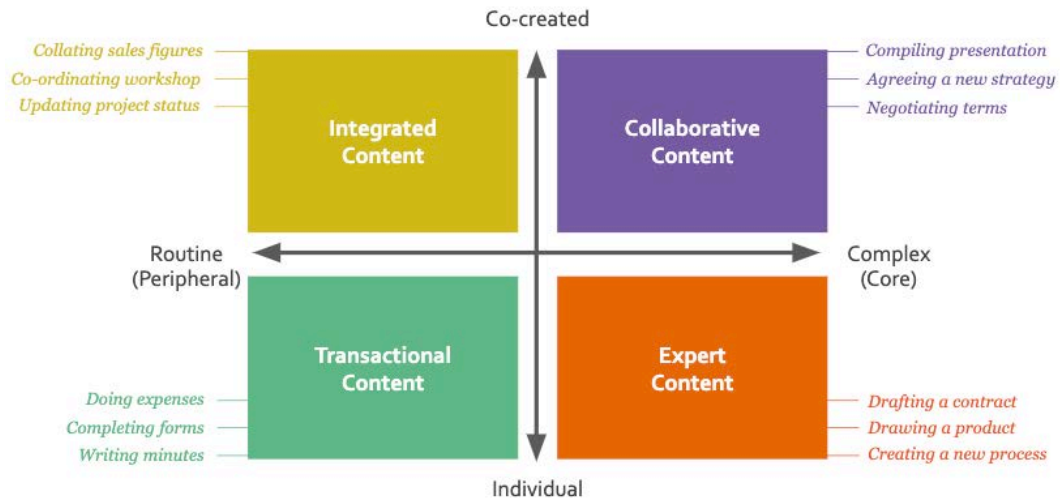


Figure 5. Adaptation of Davenport's framework based on primary research. (© Google, used with permission.)

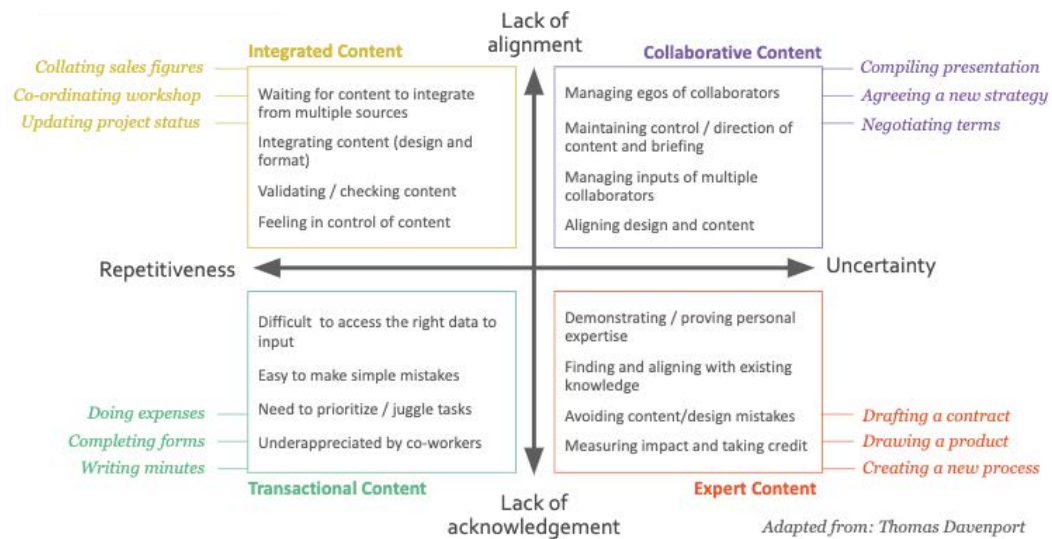


Figure 6. Barriers to content creation across content types. (© Google, used with permission.)

## WHAT (EXPERIENCE OF) ASSISTANCE DO WORKERS WANT

### Mapping the Core-Peripheral Distinction to Assistance

The core-peripheral distinction and Davenport's model of knowledge work allowed the research team to start making sense of the experience of knowledge work. However, by itself it didn't explain the support people wanted from AI or human assistance.

When discussing assistance, respondents expressed clear preferences for receiving different kinds of assistance depending on the type of task they received assistance with. The more peripheral a task was to them, the more they wanted to completely offload it from their responsibility. With core tasks, on the other hand, respondents preferred assistance that enhanced their execution of the task, without removing it from their oversight.

Seven specific types of assistance emerged from our research: remove, short-cut, anticipate, synthesize, scrutinize, improve and inspire. They can each be placed on the spectrum of assistance between offloading assistance and enhancing assistance. The following chart illustrates this with specific examples.

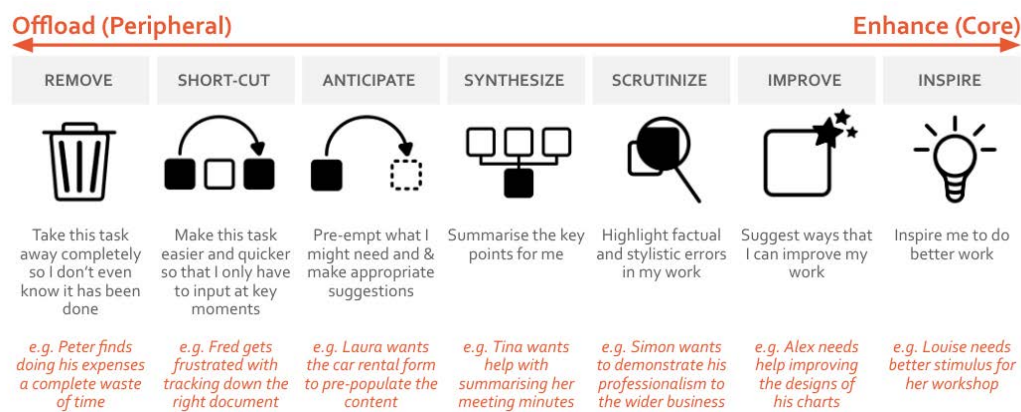


Figure 7. Spectrum of Assistance. (© Google, used with permission.)

### Offloading Peripheral Work

"I feel more busy than I should be... I get 100's of emails a day and most of them are bulls\*!t"

Ingrid, Analyst, International Bank

As Ingrid illustrates, offloading peripheral work is often less clear-cut than outsourcing expense claims. The spectrum reveals that the experience of assistance that workers require is nuanced and can vary task-to-task within a workflow. Offloading does not necessarily mean total removal of the task; it can also be about speeding up the task (short-cut), pre-empting what is required (anticipating) or simplifying complexity (synthesise).

As discussed earlier, just because workers are not always rewarded by (or find meaning in) peripheral work this doesn't mean it's not significant and high risk. Ingrid's 'bullsh\*t'

emails still require a thoughtful response. But if how she arrives at that thoughtful response can be expedited then that would be of immense value to her.

Importantly for peripheral work, it's not critical for Ingrid to feel a sense of personal agency over the task. She doesn't need to know or understand how the assistance works, and she doesn't need to take credit for it, she only cares that it's correct and produces a satisfactory outcome. Ironically this means that trust is a more important factor for peripheral work even if it is regarded as lower value work. This is because if the worker is willing to relinquish oversight they must place more trust in the agent that is working on their behalf.

## **Enhancing Core Work**

“They employed me for my personality and for my thinking. You can't teach strategic thinking — you either have that type of brain or you don't”

Peter, Strategist, global CPG firm

Unlike peripheral work, core work is directly linked to how worker performance is measured, and often to their sense of value, identity and self-esteem. Because of this workers want to feel like they are in total control of all work they define as core.

In Peter's case, he feels like he is employed because he has the 'type of brain' which is uniquely suited to his role. It is clear he derives a significant amount of self-worth from his belief about his skills, so any task which truly utilises them - such as developing a recommendation a new direction for a brand - must be responded to entirely by 'himself'. Any form of assistance received during the execution of these types of tasks must be experienced as an augmentation or extension of his own capabilities. If he felt these tasks were being done 'for' him this would not only, in his view, dilute the quality of the work, but pose an existential threat to his personal sense of value. Peter is open to his work being 'scrutinized', 'improved' and even 'inspired'. But it ultimately must remain his work, and by asking for assistance this must never be called into question.

There is a tension inherent in the concept of Core Work. As work becomes more collaborative it becomes more difficult for individuals to define and account for their specific contribution, reducing feelings of agency and ownership. For example, we noted a desire from several participants for an 'audit' trail for content they have personally contributed. Often as content is shared throughout an organisation individual contributions become adapted and merged into larger documents. It therefore becomes very difficult for an individual to know the impact their contribution is making and, by extension, take credit for that impact. Potential design implications of this for AI are discussed below.

Interestingly, even though core work is of higher value to the worker there is less need for them to trust the assistance they receive. Because workers want to remain deeply involved in their core work they have more capacity to evaluate, accept or dismiss any assistance that they solicit or receive.

## **Design Principles for Assistance**

The above can be summarised in a simple set of design principles to inform how AI-driven assistance is ideally experienced by knowledge workers. As is outlined in the impact

section below, this is one of the frameworks which is guiding product teams across GSuite. These fundamental distinctions in how assistance should be experienced has important implications for who ‘owns’ different forms of AI and how it should be implemented within organisations.

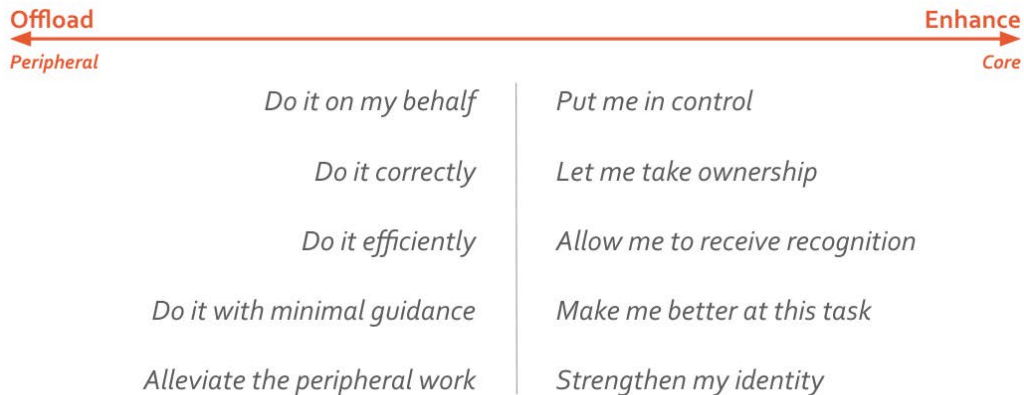


Figure 8. Assistance design principles. (© Google, used with permission.)

## Two Types of AI

The paradox of peripheral work is that while it is perceived to be of lower value, trust in the assistance is more critical because workers are delegating work that is still regarded as their responsibility. For example, you may want to delegate filing your expenses, but if a false claim is made on your behalf then that puts your reputation at risk. Therefore trust in AI acting on your behalf must be exceptionally high. Trust is established when an assistant completes a task satisfactorily on a repeat basis. In these circumstances oversight is gradually withdrawn.

Therefore workers liked the idea of offloading both agency and ownership for peripheral work. On the other hand, they wanted to experience any assistance with core work as integrated and indistinguishable from their own efforts. They wanted to maintain and sometimes deepen agency and ownership of these tasks.

In practical terms this meant they liked the idea of their employer organisation as being the agent of peripheral work, while they personally retain control of their core work.



Figure 9. Preference for ownership differs based on type of assistance. (© Google, used with permission.)

### Peripheral Work = 'Company AI'

Workers liked the idea of delegating peripheral work to a company-owned tool, meaning the company is responsible for positive and negative outputs rather than the worker. By extension, workers were open to the organisational AI being represented anthropomorphically as an external agent (like Google Assistant, Siri, Alexa etc).

This would be a resource that would be part of organisational infrastructure, and therefore remain in place if a worker were to leave the organisation.

### Core Work = 'My AI'

In contrast because workers viewed core work as integral to their value and identity, they preferred the idea of a personal AI that would move with them between organisations. As they invested time training the AI it would become increasingly personalised and indistinguishable from their own capabilities.

In this sense 'My AI' should not be experienced as an external anthropomorphic agent but as largely embedded in their workflows and practices, to the point where it is not recognised to be AI as such and indistinguishable from their own capabilities.

The idea of 'My AI' can be seen to run counter to the trend of work becoming more collaborative - in this sense a 'Our AI' may seem like a better reflection of the way that work is developing. But this runs counter to the aspirations of ownership, autonomy and agency that emerged strongly from the research. As work becomes more complex AI may actually become a tool for maintaining personal agency and autonomy as it helps individuals automatically define and track their specific contributions within the context of the whole.

## IMPLICATIONS AND IMPACT

### For Google

The two concrete contributions the work has had for Google can be summarized as:

1. *Embedding a new set of taxonomies and frameworks that inform AI-related decision making throughout the GSuite organization*

The frameworks outlined in this case study have been socialised across both the executive and product layers of the organisation, helping teams prioritise and develop strategies. Previous to this work GSuite had many successful products that provided AI-driven assistance for knowledge workers, but lacked a foundational framework with which to categorise and evaluate existing products from a user perspective, nor a clear means for understanding where to innovate in the future. Our work has provided GSuite management with a set of adaptable tools to organise and manage innovation across product teams.

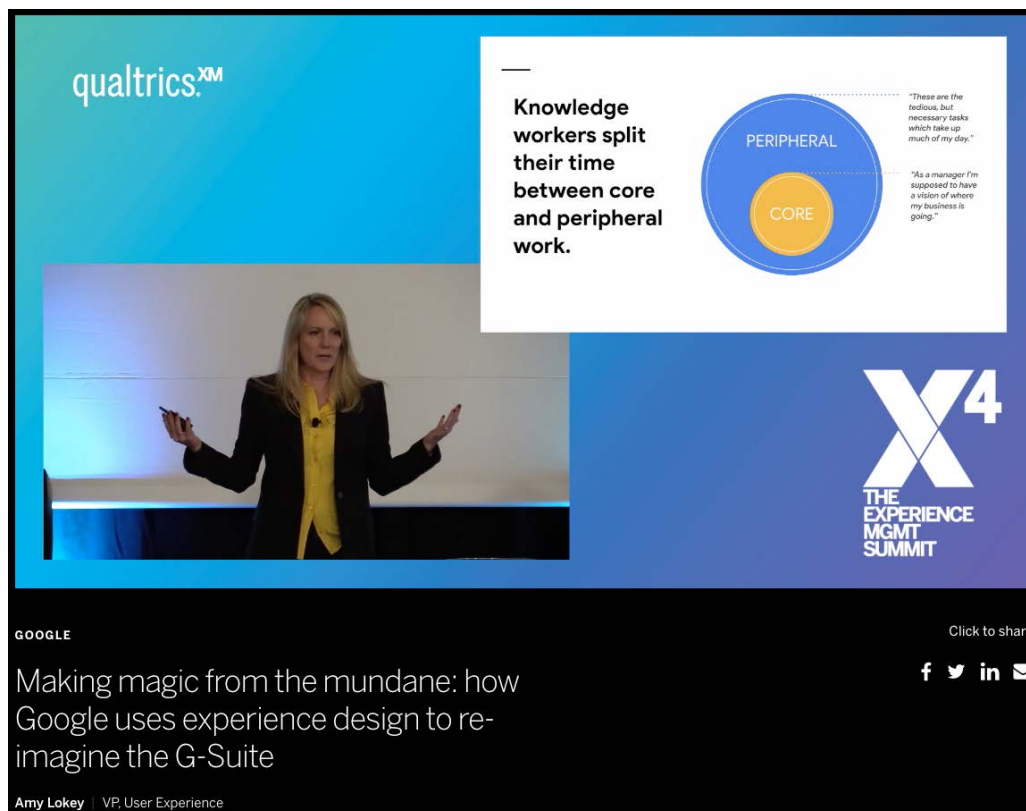


Figure 10. Amy Lokey, VP, User Experience, GSuite, introduces our foundational Core / Peripheral work framework at Qualtrics conference. (Lokey, 2018a)



## 2. *Driving product innovation within specific GSuite teams*

Each product team at GSuite (Gmail, Calendar, Sheets, Docs) is now using these frameworks to inspire and guide how they integrate AI into their products, with many examples already live

It's also important to emphasise the ethical dimension here. By highlighting a worker-first perspective of what good 'Assistance' is at work, our project has guided Google towards sensitive solutions which help workers excel at their job, by both augmenting their skills and removing aspects of their work that were blocking them from excelling.

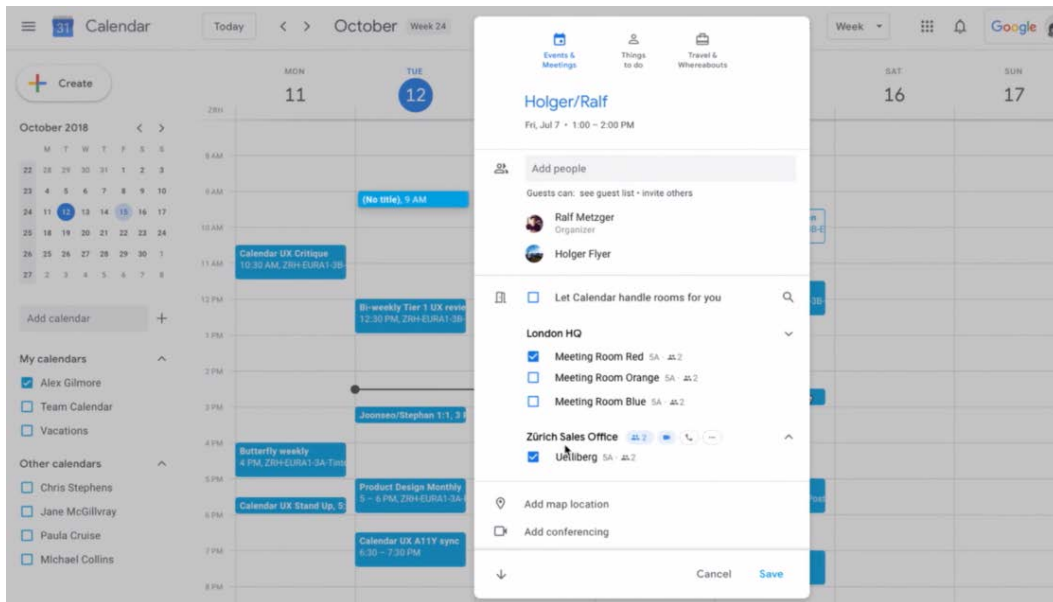


Figure 11. Calendar's new auto Meeting Room allocator is driven from the idea of reducing Peripheral Work. (© Google, used with permission.)

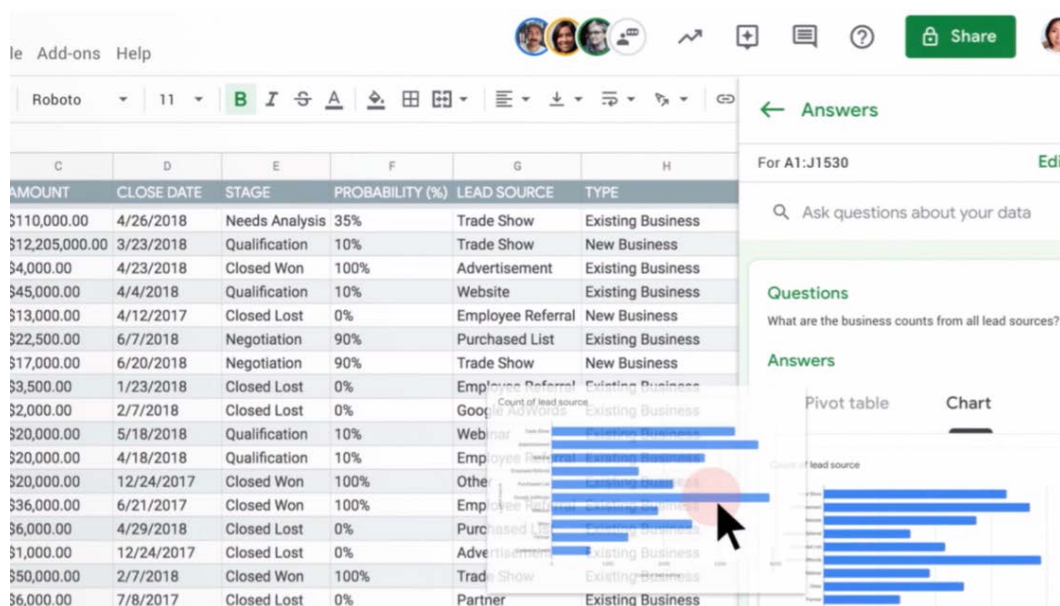


Figure 12. Sheets new 'Explorers' feature enables users to generate charts using 'conversational' queries, augmenting 'Core Work'. (© Google, used with permission.)

Our guidance would have looked different if we'd taken an IT-first perspective. As part of the project we conducted a number of management interviews with IT decision makers and it was clear their priorities were often quite different to individual workers. Their concerns primarily revolved around value for money, and seeing AI as a means to reduce costs - although there was evidence of the increasing role of worker preference in driving decision making (companies like Google and Slack have made influencing workers first central to their 'bottom-up' adoption strategies). This is not to underplay the importance of this perspective, but to emphasise the role of this project was to focus on the needs and priorities of the end user.

Public references to our work (see full reference in citations)

- Qualtrics conference keynote, 2018 (Lokey, 2018a)
- Keynote at Google NEXT conference (Lokey, 2018b)
- Interview with Teryn O'Brien for Silicon Angle (O'Brien, 2018)

## For Knowledge Work

By the end of 2018 over 5 million businesses are paying to use GSuite worldwide (<https://9to5google.com/2019/02/04/g-suite-5-million-businesses/>). The influence GSuite has over the way people do work is enormous (especially if we include the consumer side of Gmail, then the number increases to 1.4 bn users.)

By helping workers to focus on Core Work and reduce Peripheral Work, GSuite will contribute to the streamlining and specialization of roles as they are optimised towards

leveraging the specific skills and aspirations of the individual. From this perspective Knowledge Work should also become more rewarding and enjoyable as users focus on work that they find most interesting and valuable.

However, for this vision of knowledge work to be realised there are a couple of questions that warrant further exploration:

*How do we enhance Core work in a collaborative environment?*

Work is simultaneously becoming more complex and more collaborative. Given each worker has a personal incentive to focus on Core Work this may lead to tensions as work overlaps and workers compete to do the same high-value work. And more importantly, given that Knowledge Work requires increasingly complex forms of collaboration, it may become more difficult to define and quantify unique contributions and, by extension, the nature of “your core work” vs “my core work”.

One outcome may be that role definitions becoming increasingly collective and integrated, so that Core Work is not defined in such individualistic terms. Alternatively AI may actually help workers parse, define and measure their contributions in this more complex environment. This is an area that we would like to explore further.

*How will the removal of Peripheral work affect Core work?*

Just like other workers, it is easy for ethnographers to segregate the work we do between ‘Core’ and ‘Peripheral’. For example, we may want to minimise the logistical burden inherent in conducting global fieldwork. From organising transportation to syncing meetings across time zones there are many tasks that seem to detract from time spent on what we commonly think of as our core work (namely field research, pattern recognition, meeting with clients).

However, there is a danger in minimising work that is perceived to be Peripheral. Last year at EPIC we outlined the danger of ‘AirSpace’ - the idea that global platforms like Google, Uber and Airbnb are making ethnography ‘frictionless’ and thereby reducing its richly textured scope to an extended interview (Hoy, 2018). To put it simply, sometimes getting stuck on public transport may feel like Peripheral Work, but it can also lead to the most unanticipated, abductive insights. In this sense, the work we perceive to be Peripheral may be reframed as Core.

In this sense removing the rough edges of Knowledge Work may not always be a good thing if it restricts our idea of what our work is, or could be. And this may be a challenge that extends to other Knowledge Workers too. This is another area we would like to dig deeper into.

## **For Ethnographers**

There are some important learnings from this project on how we study AI as ethnographers. In the context of work, we found framing ‘assistance’ in human rather than technological terms was an important way for us to begin our conversations with participants. This enabled us to put pre-existing ideas about AI (from media narratives about jobs being automated to consumer instantiations such as Siri or Google Assistant) to one

side and focus on the everyday support they would appreciate at work. It was only once we established these ground rules that we introduced the idea of technology.

Secondly, performing ethnography with multiple workers in the same team enabled us to better understand the distinctions and tensions between individual autonomy and teamwork, and how one person's Core work can be another person's Peripheral work. Also, we could triangulate between the claims of different workers and observe team dynamics, enabling us to build up a truer picture of everyday work.

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## Empowered, Confident, and Prepared Driving Chatbot Product Vision Through User Research

MOLLY MAHAR, *Salesforce*

GREGORY A. BENNETT, *Salesforce*

*This case study explores how a series of customer site visits to two international service centers drove design recommendations for a chatbot building platform that could encourage positive agent-chatbot collaboration. The first part of the case focuses on the research undertaken by a team of user experience practitioners at the enterprise software company Salesforce. The team used contextual inquiry and group interviews to better understand the daily experience of customer service agents and service teams in search of ways to responsibly implement automation tools like chatbots within a service center environment. The second part of the case study highlights how the UX team applied these learnings into specific product recommendations and developed a set of principles that could drive the product forward while remaining empathetic and supportive of customer service agents.*

### INTRODUCTION

In contrast to their job title, customer service agents aren't treated as if they have much agency. Service agents are trained to follow precise scripts and protocols when dealing with problems, and may be quite limited in what power they're granted to actually solve a customer's problem. Their shifts are scheduled to coincide with convenient hours for customers, not necessarily for agents. Agents deal with customers in their worst moments: frustrated, angry, scared, stressed; typically, customers drive the tenor and direction of the conversation. Agents rarely get to hear first-hand about successful service they might provide, because happy customers don't call back to say "thank you." Even if they did, it would be exceedingly unlikely for those customers to get routed back to the same service agent who helped them initially, because of the way automated software routing processes function. Lacking much agency in their day-to-day work, customer service agents can be a vulnerable worker population, treated as low-skill, expendable, replaceable, seasonal workers. The subreddit "Tales From Call Centers" ([/r/Talesfromcallcenters](https://www.reddit.com/r/Talesfromcallcenters/)) is full of first-hand accounts that highlight these issues for call center employees, demonstrating how this job can be deeply punishing, and only occasionally rewarding.

Larger companies often segment their customer support into different "tiers," or levels of service (Kidd and Hertvik 2019). A Tier 1 agent is less experienced and less knowledgeable than a Tier 3 agent, who has learned the ropes and the products and is expected to be an expert. Tier 1 agents are the most vulnerable population: they are paid the least, have the least power and autonomy in a customer interaction, and are the most replaceable. They are also the most likely to be automated out of a job as companies look to streamline operations and encourage customers to help themselves through self-service. Self-service, for these companies, is considered Tier 0, which includes instances where the customer finds the information themselves, whether through help articles on the website or through a chatbot. The future job outlook for customer service workers is both expanding and contracting, depending on industry (Leopold, Ratcheva and Zahidi 2018), and likely also on level of expertise. On the one hand, even in an automated world, people still like to be

served by other people (that “human touch”); on the other hand, more and more companies are interested in automating Tier 1 tasks down to Tier 0 (self-service) tasks.

There is a very public conversation happening around how the fear that automation will eventually take over everybody’s jobs. Automation and self-service can be seen as two perspectives on agency: automation equates to people losing agency, and self-service equates to people gaining agency. Often, it’s a balancing act between customer service agents and consumers—and consumers seem to like self-service. There were days when nobody pumped their own gas at the gas station, when every flight check-in involved speaking with a desk agent and printing out a physical ticket, when librarians were the only people with direct access to shelves of books. These days, do most people consider pumping their own gas to be *automation*? For a consumer, self-service (e.g., finding an article online to assist with a problem, using an ATM to get cash, or getting help with a problem from a chatbot) *is* agency. They now have the power to solve their own problems, on their own schedule. For a service agent, companies’ efforts to provide self-service to consumers, and therefore agency and convenience, results in automation solutions that have the potential to help or hurt service agents, depending how they’re designed and implemented.

It is precisely because of automation’s potential for both good and harm in the lives of customer service agents that the User Experience (UX) team for the new chatbot builder product at Salesforce sought to visit customer service centers and observe and learn from agents. Since chatbots for customer service were still relatively new, Salesforce’s new product offering would be the first time that many large enterprise customers had ever considered building a chatbot to assist their customer service organization. Because of this unfamiliarity, the UX team wanted to provide best practices and recommendations around how to responsibly and effectively launch a customer service chatbot in a service center. They did not feel confident building a platform without knowing how to build protections and best practices into it that could benefit service agents while also benefiting the companies for which they work. To better understand how automation might be beneficial to service agents, and therefore how to build that into the chatbot building product, the UX team needed a deeper understanding of the experiences of customer service agents.

## RESEARCH GOALS

In order to provide recommendations on how to responsibly implement automation, the UX team needed to have a deep understanding of the real-time experience of service agents, as well as which parts of a customer service agent’s job were expendable and which parts were enjoyable and satisfying. The team also needed to understand how service centers functioned so that they could provide a product that would successfully automate the parts of a service center agent’s job that *were* expendable. In order to implement responsibly, the team needed to better understand how automation might change (for better or worse) the agents’ current jobs. Did agents think about how or where automation could take something repetitive off their plate? Did they feel threatened or excited by automation, or feel something else entirely?

Customers tend to ask questions or seek help via many channels, depending on availability, context, and customer preference. Common channels are phone, email, web chat, mobile messaging, and social media. Since chatbots are text-based, the highest priority for the team was seeing live chat service agents in action, to most closely reflect the cadence

and issues that companies are likely to use chatbots to assist with. Because different channels require different skill sets, the UX team hypothesized that agents serving different channels might have different needs or desires around automation.

It is important to note that this research was not intended to develop personas around customer service. Salesforce as a company conducts quantitative surveys on a cadence to develop, refine, and modify its user personas based on how its end users interact with the software. The company had already developed and disseminated personas that captured the three major user groups that the UX team would need to interact with: Tier 1 customer service agents (called “case solvers” in the Salesforce parlance), experienced Tier 2 or 3 service agents (“expert agents”) and support team supervisor-managers (“team leads”).

## THE OPPORTUNITY

At Salesforce, user experience practitioners interact regularly with the users of their software. Designers and researchers remotely interview Salesforce administrators (those responsible for configuring the software to align with business processes), sales reps, customer service agents, marketers, business analysts, and others. Customer service agents are notoriously difficult to interview and observe because their time is so tightly controlled and managed by their organizations. Every second counts, and thus it is difficult to send observers into call centers. Responsible data practices, in conjunction with laws around privacy such as GDPR, preclude the sharing or saving of end customer data, making it nearly impossible to observe service agents at work without going onsite and observing in person. Their screens always reflect private information about the customers they’re serving, so companies—Salesforce’s customers—are rightfully protective of that data and do not share it.

In addition, because the product was just launching, there were very few customers using Salesforce chatbots yet. While it would have been ideal for the UX team to observe agents who were already interacting with chatbots from a support perspective, the immaturity of the technology space meant that the team would likely have to settle with just observing chat agents, and deriving insights and recommendations from their current experiences.

While pursuing opportunities to meet with business customers, the UX team was offered the opportunity to join another product team that had planned a visit to call centers in Manila, the capital of the Philippines. It was an interesting opportunity because the team would visit two call centers that provided outsourced support to the same large fitness technology company, a Salesforce customer. This provided the opportunity to see how multiple service centers functioned to serve the same ultimate client and customer base. The call centers provided English-language support in all major channels: phone, email, web chat, and social media. The visit provided a perfect opportunity to get baseline knowledge of the chat agent experience prior to the implementation of chatbots, and see where chatbots could help or hinder from an agent perspective. In addition, because Manila is an international hub for outsourced customer service, the team expected that these vendors would provide an accurate view into the experiences of high-volume, outsourced service agents in particular—those who are most likely to have their jobs affected in some way by automation, because they are the least visible to the decision-makers at company headquarters.

The UX team traveled to Manila to observe service center agents over the course of five nights. Manila is a hub for international customer service center outsourcing, so the two companies that the UX team visited both supported one large Salesforce customer on a non-exclusive basis (the vendors also had other enterprise customers). The service agents that the team observed were scheduled on the overnight shifts, so that they could support English-speaking customers in the USA and the UK during local business hours.

## **METHODOLOGY**

As noted previously, the primary research goals were to 1) understand the daily experience of service agents at their jobs, 2) understand at a high level how high-volume service centers functioned operationally related to agents and automation, and 3) understand how automation might change a service agent's job from an agent's point of view. This knowledge would then allow the chatbot builder UX team to develop concrete recommendations on how to responsibly implement chatbots within a service center, to benefit end consumers as well as the customer service agents who must work with chatbots in a new kind of human-machine collaboration. To address these three goals, the team planned to shadow service agents while they did their job, conduct brief interviews during or immediately after their shifts or interactions were completed, and interview team leads (customer service managers) about the operation and functions of the service center as a whole.

### **Contextual Inquiry With Case Solvers**

To understand the daily experience of service agents at their jobs, the UX team planned to shadow agents while they worked, observing:

- The general environment of a customer service center
- The general flow and schedule to develop a sense of a “typical” agent workday
- How issues progress up the tiers of service, from Tier 1 to Tier 2 or 3 (typically called “escalations”)
- Any ways that agents collaborated with other agents in the course of their jobs
- How and why agents used pre-composed responses in their interactions with customers, and how they maintained and accessed them (pre-composed responses were known to be used by at least some customers because Salesforce offered that functionality in other product features)
- Any differences in the above based on channel used (email, chat, social media, or phone)

During and after these shadow sessions, the UX team planned to conduct short interviews with the service agents to probe more deeply into how agents saw automation potentially affecting their jobs, specifically:

- What portions of the job pleased or satisfied agents, and which portions of the job were displeasing or negative?
- Where did they see automation as being helpful to them? Harmful?
- Were they worried about automation? Did they think about it at all?



The service vendor made many of their customer service agents available, such that the UX team was able to spend 1-2 hours with each agent, and observe between two and six agents each evening. Over the course of the five nights, the UX team observed agents that handled cases via chat, email, phone, and social media. During these shadow sessions, the researcher would introduce themselves and then sit beside the service agent while the agent took phone calls, or received and responded to emails, chats, or social media messages.

With the written channels, the researchers would often ask clarifying questions about what they'd just seen on screen, or why an agent did something one way or another. The researchers observed and noted what windows the agent kept on screen, how they arranged them, and what their desks looked like. The UX team found that asking these questions during the course of the agent's workflow was much easier during cases on a written channel, since the customer on the other end of the correspondence didn't know or need to know that there was an observer present. With service agents handling phone calls, all follow-up questions and clarifications needed to happen after the end customer had hung up the phone and the issue was resolved.

To interview agents about automation, the UX team planned to either ask questions during the course of handling customer issues, or to obtain 1:1 time with agents during breaks in their shift and interview them off the floor of the service center, if possible. These interviews were planned to be only a few minutes long. The team ran into a number of issues when attempting to address this portion of the research and was unsuccessful, which will be discussed shortly.

## **Interviews With Team Leads**

To understand how these service centers functioned at a high level, including areas of automation, the UX team planned to interview team leads and supervisors to learn:

- How they would want to change their current setup and workflows
- How they measure current KPIs (key performance indicators) for agents, and how those might change with increased automation
- How supervisors interact with other agents in person on the floor and digitally, during the course of their job

It was unclear prior to the visit what format would be made available for interviewing team leads and supervisors. Upon arrival, the team learned large group sessions had been planned by both vendors. In these sessions, the vendors' participants were a mix of team leads who supervised the teams of agents, and the service account executives who maintained the relationship between the vendor and the fitness technology company, which manages the actual Salesforce implementation and is a Salesforce customer. The Salesforce administrator was also part of the sessions; he traveled with the UX team from the US and is an employee of the fitness technology company.

During these group sessions, team leads discussed areas for improvement in how to implement the Salesforce system, including workarounds that Tier 1 agents at one of the vendors had discovered in order to disassociate themselves from negative customer feedback. Employees discussed common KPIs that were used, including Average Handle Time (AHT), which is a common service center metric. Most of the employee-supervisor

interaction data was actually gathered observationally during shadow sessions with Tier 1 agents, rather than being investigated during the group sessions.

**Table 1: Study parameters**

Method	Number of Participants	Service Cloud User Persona	Service Channel	Location
Contextual Inquiry	12	Case Solver	Chat	Vendor 1
Contextual Inquiry	5	Case Solver	Email	Vendor 1
Contextual Inquiry	9	Case Solver	Phone	Vendor 1
Contextual Inquiry	2	Case Solver	Social Media	Vendor 1
Contextual Inquiry	10	Case Solver	Chat	Vendor 2
Group Interview	12	Team Leader	Chat, Email, Phone, Social Media	Vendor 1
Group Interview	5	Team Leader	Chat	Vendor 2

## Lessons Learned

One interesting development that was unexpected was that the Tier 1 service agents did not seem to understand that the UX team that was observing was unrelated to their clients, the fitness technology company. Because the UX team traveled and arrived along with the Salesforce administrator who represented the fitness technology company, agents universally seemed to assume that the observers were all part of the same group. Even after introductions that the UX team came from the software company that made the software that the agents were using, agents did not seem to grasp nor care that the UX team was not from their client company. However, because the different teams traveled and arrived together, it was very clear to the agents that it was acceptable and expected that they would solve cases somewhat more slowly that day due to having the distraction of answering questions and having an observer present. Having that tacit support, as well as verbal support from the Salesforce administrator (who was, ultimately, the only representative from their client, the fitness technology company), did seem to make agents much more comfortable having the UX team ask questions and dig into their workflows.

This mistaken assumption that the UX team was in fact working for the vendor's client may have led to more reticence in any answers that would have shown concern or trepidation around the potential for automating the agents' jobs away. Due to the volume of issues these call centers handled, and the nature of the vendors' oversight, the UX team was unable to conduct 1:1 interviews with Tier 1 agents outside of the shadow sessions. The goal for those had been to uncover agent attitudes about automation and, in particular, about

working with chatbots. The UX team also observed that agents were not forthcoming about, or not interested in, revealing any attitudes about automation while working on the floor. This was understandable due to the close physical proximity of other agents and supervisors, who roamed the floor and could easily overhear anything that was said by the agents. Agents were willing to discuss how they currently used automations, and where automation might speed up their workflows, but they did not discuss anything that might be seen or construed as critical to the way the service center functioned or was managed. The UX team thus focused mainly on observations and clarifications after a few failed attempts at digging deeper about automations.

Somewhat similarly, with agents handling phone calls, the observations did not include much time or space for questioning outside of clarifications. Researchers were given a pair of headphones without a microphone and were connected to the live calls to listen in on both sides of the conversation between the agent and the end customer. Agents clearly couldn't answer researchers' questions while the phone line was open, so the UX team had to reserve any questions until after the call was closed out. But that is also the time that agents must complete their "after-call work" (ACW), or case wrap up, which typically involves typing out a summary of the conversation as well as the steps taken to resolve it. At the vendor observed, agents are given roughly 15 seconds to complete this work after every call, before being given a new call. The new call is signaled by a short tone on the phone line before being automatically connected—the agents do not physically pick up a phone nor do they press a button to connect. It happens automatically. There were often moments when a question or an answer between the agent and the UX team went unanswered or was cut off mid-sentence due to an incoming phone call. Those incoming cases happened with the same frequency on the written channels (web chat, social media messaging, email), but the agents had a much easier time multi-tasking, and were able to answer lingering questions while still handling the customer case in front of them.

## **KEY FINDINGS AND TAKEAWAYS**

As part of a software development team, the UX team makes use of broader organizational data-derived personas to help shape and direct their product development efforts. As noted previously, the three relevant ones to this research activity were the "case solver" (a tier 1 service agent), the "expert agent" (an experienced agent), and the "team lead" (a team supervisor). It can be easy to fall into rote acceptance and recitation of these personas to one's product development team if one does not actually interact frequently with the end users of one's product. There is a level of empathy that develops through the richness of small details, the ones that escape the persona and provide real texture to the experience. These minor details often end up being the difference between a development team that truly understands and aligns on why certain product choices are being made, versus one that is simply going along with decisions made by others. The UX team was lucky to observe a number of these textural experiences while learning about agents' daily work and the operations of service centers.

## Life in the Service Center

There is a surprising amount of security in these multi-tenant call center buildings. Security guards with sign-in sheets and metal detectors were present at both vendors where the UX team performed research. Proximity badges and visitor badges were required for entry into any room. The UX team, as visitors, received special badges that allowed them to bring computers, phones, and note-taking equipment (literally, pens and paper) into the call center. Agents themselves were not allowed to bring phones, pens, pencils, or computers onto the service floor—they had lockers in the hallway where they left their personal belongings. The security risk stems from the customer data that outsourcing vendors have access to in the course of their job; clients do not want agents walking off with it.

Interestingly, the security guards always greeted those entering the premises with “Good morning,” even though it was the middle of the night when the team arrived and worked. The teams worked the overnight shift, serving English-language customers in the US and UK. “Good morning” seemed to be the standard greeting for the night shift, since they are just starting their day—it sets the tone that agents will be providing support to people who, in their own time zone, had just begun their day.

The UX team learned, from agents themselves and from their team leads, that most agents in the Manila service center lived many hours away. Some had traveled on three or more modes of transportation to get to work. Since agents often lived far away and weather could be unpredictable, one of the two call center vendors had created sleeping areas where agents could stay and sleep if they were trapped by a monsoon or other inclement weather that affected transportation home.

Entering a call center is much like entering many of the open-plan offices one might see around the world these days. There are groups of agents in pods, formed by a few short rows of desks, and the channel that those pods handle can be identified somewhat by sound. The agents that handle phone calls are always speaking, often quite loudly, leading to a much louder pod. The chat, email, and social media pods are much quieter by comparison, with chat agents being the next loudest. This was due in part to the speed at which they type, the audible alerts that the software puts out when a customer has been waiting too long for a response, and the general chatter that happens as agents speak to one another or ask questions of their supervisors. (The supervisors are always roaming the floor, available for help but also checking over agents’ shoulders and keeping tabs on everyone.) Email and social media pods both operated at a much slower pace than phone or chat, and were thus quieter.

There was a hierarchy to an agent’s job and advancement opportunities at these vendors, as the UX team learned from one of the vendors. Agents typically begin their careers answering emails, which have the most flexibility in response time. Agents will then graduate up to handling chat inquiries, which require faster response times and involve handling more than one chat simultaneously (typically 2-3 conversations). Agents who have been successful on chat might then be upgraded to handling phone calls, *if* they have a good spoken demeanor and high energy. Many of the phone agents used a nickname to introduce themselves to customers, rather than their real names (which in this case were longer or more complex than the names they gave to customers). If an agent succeeds at chat but is not a good fit for handling phone cases, they could be promoted to social media. Social media has a more relaxed timeline, like email, but the added stress that responses are often

*very* public. For this reason, only the most experienced and talented agents were assigned to handle social media issues at the vendor the team visited. They must know the products, and know how to handle customers well so that issues don't become publicity nightmares. Agents on social media are a much more visible representation of the client company, so they are chosen carefully for their skill and experience.

## **The Chat Agent Experience**

Since chatbots initially will be used on live chat channels, the UX team was primarily interested in observing specifics about how agents on chat channels dealt with customer problems. These observations highlight what the team learned about agents working that channel in particular.

The UX team was able to observe the speed at which chat agents typically responded to customers, above and beyond the SLA. An SLA is a "Service-Level Agreement," which is typically a contractual agreement specifying exactly how long a customer can expect to wait before their issue is resolved (Wikipedia contributors 2019). A client company might promise their consumers that they will solve any problem within 24 hours, for instance. Customer service vendors are thus obligated to also follow that client guideline when dealing with consumer issues. In addition, there are typically internal, procedural SLAs, such as ones that might require a problem to be assigned to an agent within two hours, or closed within eight hours. At these vendors, there are other process requirements for chat, for instance, that customers shouldn't be kept waiting more than two minutes without a response from the agent with whom they're chatting. The UX team also observed processes around how agents could only close out cases (mark them as "resolved") once the customer had confirmed and ended the chat themselves. Otherwise, sometimes agents were left to wait a specified period of time before being able to say that the customer had abandoned the chat. The UX team found that chat agents would typically respond within a few seconds to the customers. This response time was aided by the fact that the service center software allows the agent to see what the customer is typing into the message input field before the customer hits "Enter" to send the text. Thus, by the time the customer finally "sends" their response, the chat agent has already had a chance to see what's coming and start finding an answer and drafting their response outside of the chat window.

During the course of these chats, agents made extensive use of pre-composed responses that they would copy-paste from somewhere else into the chat window, then modify (for instance, with the customer's name) before sending. The UX team observed different workflows around these pre-composed responses, depending on the vendor, leading them to believe that the client itself did not provide or dictate what these responses should be. The agents called these their "spiels" at one vendor. Agents seemed to maintain their pre-composed responses in their own voice and tone, though many noted that they would share their responses with others, or that someone else had helped them get started at the call center by sharing their documents with them. These pre-composed responses were manually maintained, searched, and copy-pasted, making them a significant automation opportunity. Indeed, the client (the fitness technology company) had already programmed a set of pre-composed responses in the Salesforce system as "macros". The UX team observed that agents used a much larger number of pre-composed responses than were available and curated, however.

The UX team was also able to observe a number of chat escalations, whereby a case solver in Tier 1 (the lowest-level agents) passed a customer case up to a Tier 2 or 3 expert agent who was better equipped to handle it or the customer. The team observed that the chat agent who was originally handling the case, upon realizing that they would need assistance, would flag their supervisor, either over chat or by raising their hand or even walking over, provide a brief summary of the issue, and ask for help. The supervisor would then decide who would receive the escalation, and either the original agent or the supervisor would give the Tier 2 agent a quick summary of what was coming. This was a very interesting observation, because the customer service software can automatically escalate from one tier to another tier or to specific agents. Thus, it was a workaround and a clear preference at this vendor to have agents interact directly before handing over a case. This was another area where the UX team saw an opportunity for automation to potentially assist, because the agents clearly found this interaction method useful for both tiers of agents.

### **Agents + Automation = Teammates**

The UX team aims to keep ethical and responsible product development front and center, and although they weren't able to get candid responses to their planned interview questions regarding how agents felt about automation, the team was able to better understand how agents saw themselves and their occupations. Chat agents in particular claimed a satisfaction in solving problems *quickly*. This is perhaps unsurprising, considering they are judged on the speed of issue resolution (average handle time, or AHT). Agents did not have much time during the workday to interact casually with other agents at their tier, but they did regularly communicate via internal chat channels. They made an effort to communicate with other agents to learn from them, to share pre-composed responses, and to provide context to escalations. Thus, agents seemingly found such communications of enough benefit to outweigh any potential negative impact to their resolution time.

The behaviors that the team observed agents take—reaching out and receiving help, providing a heads up to colleagues before escalating a case to them, sharing resources that had been helpful—all seemed designed to help agents feel a sense of preparedness and confidence in the work they were doing and the new problems they were encountering. Since the UX team wanted to maintain empowerment at the core of their experience, the team outlined how agents interacting with a bot should feel: empowered, confident, and prepared. These principles also point to developing bots as *teammates*, rather than as agent replacements. Many large companies seek to develop automation in ways that do not negatively impact their existing agents; the UX team now had a set of design principles that could drive their product design decisions. Would a certain feature make an agent feel more empowered? More confident in their solution for consumers? More prepared to handle new issues? These were the types of features that the UX team wanted to incorporate into the product vision. The behaviors observed around how colleagues interacted also provided insight into how a chatbot could potentially be seen and integrated as part of the team, and be respected as such. Ultimately, it seemed that if a chatbot could help agents continue to solve problems, and do so more quickly, it was likely to be accepted as a teammate.

## **IMPACT ON THE PRODUCT**

The UX team was able to walk away from their weeklong observations with a number of specific design recommendations that could be implemented over time, providing both immediate and long-term value to the bot builder product. Features for customers, like a bot response delay (intentional friction) for more natural conversations, could be implemented immediately. Longer-term recommendations around escalation summaries, a use case for de-escalations, and deeper voice and tone customization have also been adopted to varying degrees. Those long-term features are agent-focused, designed to provide agents with more confidence and make space for more high-value interaction time with customers when handling cases.

### **Bot Response Delay**

In the short term, the observations allowed the UX team to provide best practices on how to adjust the timing of the bot's responses during chat to more closely match expectations that customers would have developed through chatting with human agents. The value proposition of using a chatbot as a frontline Tier 0 resource, which then escalates issues the bot cannot solve to Tier 1 agents, relies on the bot responding quickly to all customer inquiries. However, the UX team had learned in prior research that when companies' bots had been responding instantaneously, it felt unnatural to consumers—especially when multiple messages would arrive at the same time. Observations in the service centers allowed the UX team to provide specific recommendations around timing, and to determine that since human agents at their quickest responded in 1–4 seconds, bots could respond in that timeframe and still be considered a fast response, without the need to respond instantaneously. The chatbot building product was updated in the next release cycle to include a variable “bot response delay” feature that would allow companies to choose a delay time that felt right for their conversation design and customers. The chatbot processing engine would then add this delay to each message, to stagger the arrival of a series of messages sent in quick succession, and to allow consumers a brief chance to read each message before the next one arrives. This feature was designed to benefit end consumers, and does not impact customer service agents, although it was developed through the observations of their chat conversations.

### **Conversation Summaries**

Observations led the UX team to learn that summaries could offer value not only during escalations, but also after the fact, as a way to handle case wrap up and help agents quickly take note of what was done to help the customer. The potential value of providing a summary of a chat conversation seems incredibly obvious in hindsight, but the accepted viewpoint prior to these observations was that agents just read the chat transcript as they received an escalated case, and that that worked fine. Seeing how Tier 1 agents prepped their colleagues in Tier 2 when a case was coming was somewhat revelatory for the UX team. What the team observed was that agents were chatting quickly and handling multiple cases at one time, such that they didn't reliably have time to read over an entire chat before needing to respond and help the customer. Successful summaries, on the other hand, could help keep

responses within the designated SLA time period, and keep customers happy. This in turn could help agents feel confident and prepared when they address cases that may have been escalated to them by a bot. The content of the summary is also important. The team observed that agents were not telling expert agents *what they'd said*, but rather *what they'd done* to help the customer already, and what had, or, more frequently, had not worked. This meant that summaries should ideally be action-oriented: what actions had the chatbot taken already, and what were those outcomes? That information could be quite useful to a Tier 1 or 2 agent, who could then hop into a chat with an acknowledgement of what had been tried already, and an immediate plan for next steps. The concept of adding a summary has been added to the product roadmap for multiple automation-related products at Salesforce since being introduced by the chatbot UX team.

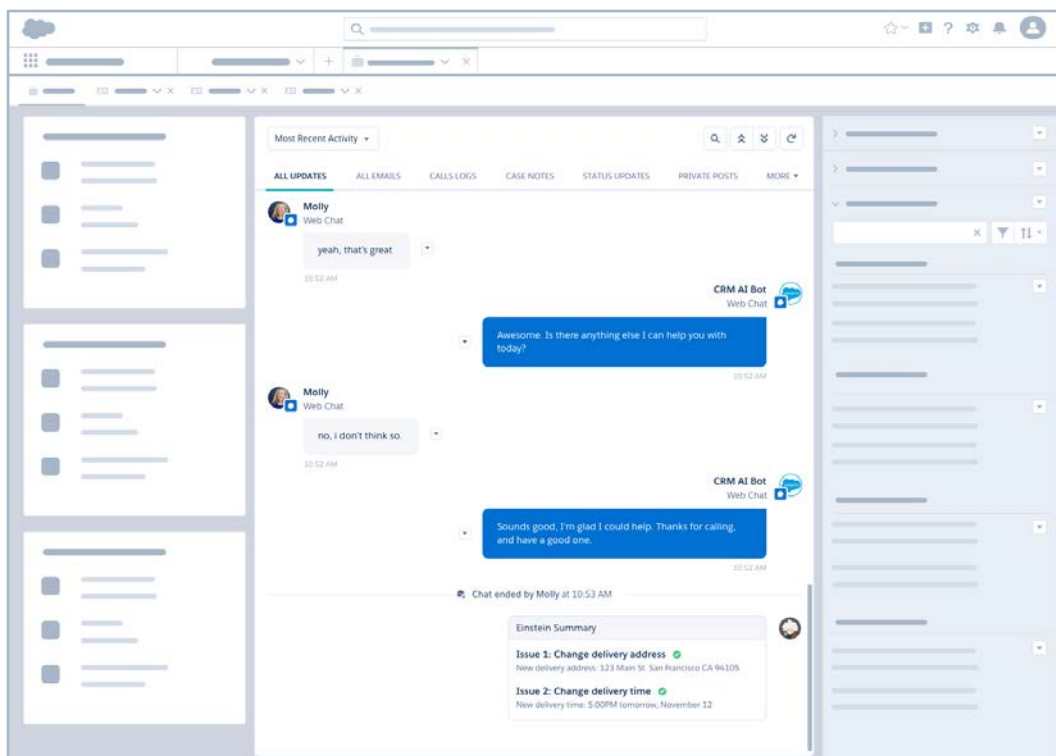


Figure 1: Wireframe of a chat transcript within the Salesforce Service Cloud agent console that contains the suggested summary component in context at the end of the conversation. Image © Salesforce, used with permission.



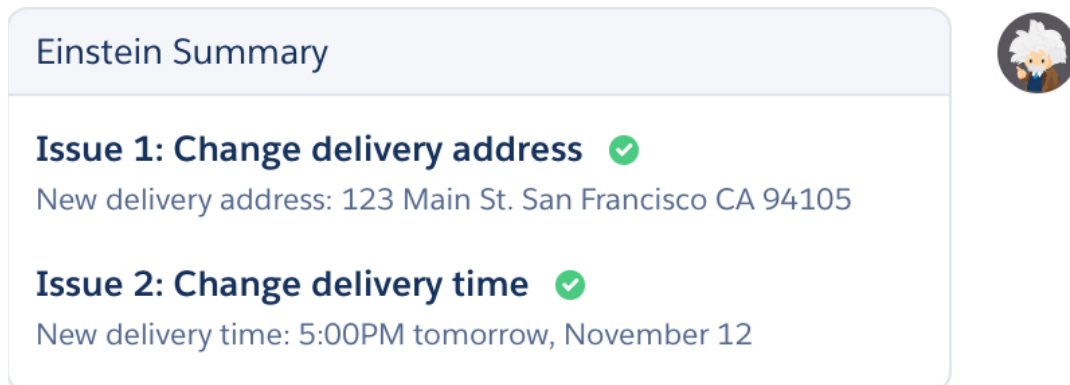


Figure 2: Wireframe of the summary component. Image © Salesforce, used with permission.

### Agent-to-Bot Handoffs (De-escalations)

Observations also revealed a need for de-escalations: when an issue goes from a higher tier to a lower tier of service. In this case, the UX team saw value for agents to be able to pass conversations back to bots, who could then handle simple interaction flows for them. The UX team observed many agents waiting for the SLA to run out when a customer didn't respond, before they could close out a case. This wasted precious moments for the vendor's client company—time during which the agent couldn't help another customer, but also wasn't helping their current customer—as well as appearing quite boring to the agents themselves. The UX team hypothesized that being able to hand a conversation back to a bot that could “close out” the conversation and ensure that the customer had, indeed, left the chat, could open up the agent's time and either give them more breathing room between chat conversations, or allow them to accept a new chat if they wanted. A pared-down version of this feature, allowing a bot to handoff a conversation to another bot, has been implemented in the chatbot builder product already, and agent-to-bot handoffs are now an acknowledged opportunity area by the chatbot builder product team.

### Voice and Tone Customization Tools

Finally, seeing how each agent customized and curated their pre-composed responses, the UX team recommended adding features addressing voice and tone customization in the future. As a customer calling a help desk, one might feel that the agent is simply following a script—and in some ways and for some questions, they are—but the team observed that those agents actually spent a great deal of effort trying to optimize their response time while adding their own personal touch to each of their communications. Bots should do the same, and if agents had helper bots that they could de-escalate to, those bots should be customized to fit the voice and tone of the agent with whom they're working.

## COMMUNICATING THE RESULTS

After every research engagement, the UX team posts a research report to an internal website so that it is accessible to the rest of the UX organization and product stakeholders. In this case, because the findings impacted multiple products, the team also gave a presentation for the entire UX organization that highlighted the research done and the guiding outcomes that now drive the product—Empowered, Confident, and Prepared—after the service center observations. Salesforce UX is very user-driven, and agent agency in particular is a hot topic for the organization, so designers were very engaged. The goal with that presentation was to drive more empathy amongst designers by providing a very visceral description of the call center life, and bring more detail into the persona of a service center agent, a “case solver.”

Chat summarization, in particular, has been presented numerous times in internal company executive summits, because it impacts a number of chat-related products that incorporate intelligence. Summarization is not only relevant to bot interactions, but can be applied to wrap up activities as well as analysis on cases. The designs for summarization, originally created to be used in chat escalations from bots to agents, have thus seen more life and are currently being incorporated into three different products.

In addition, this research has seen a long lifespan due to its first-hand nature. It provides a wealth of anecdotes that can be drawn on by the UX team during discussions with product management, engineering, and other stakeholders. Learnings from the research have even been incorporated into best practices that are recommended to customers worldwide who are using the Salesforce Einstein Bots chatbot building product.

## CONCLUSION

This case study reveals how informative an ethnographic observation can be, even when key research questions aren’t answered. The UX research team never was able to get first-hand responses to how agents felt about automation, beyond immediate ways that agents could be helped by minor automations in their workflows. And yet, the observations yielded a wealth of information that led to a richer, deeper understanding of the end users that the bots UX team was designing for. Such is the value of ethnography, to provide insight even while withholding concrete answers.

Customer service agents, like most other employees, find satisfaction from doing their jobs well. They seek to solve customer problems. The challenge is how to provide agency without autonomy, because it is unlikely that at any time in the near future, companies will give customer service agents complete autonomy over their schedule, what questions they answer, or even their time. The nature of a service agent is to be ready at a moment’s notice to respond to nearly any inquiry. Empowerment and agency in this context, then, means providing resources to allow agents to do this efficiently and to allow them to move up the ranks and gain recognition and skills from learning to address new problems.

The chat center observations that the UX team undertook in Manila also allowed the team to better understand what allowed agents to be confident and prepared in how they handled conversations with customers: they had a library of communal knowledge that was regularly curated and updated, they communicated with others when they needed their help, and they took advantage of every opportunity to provide better service to their customers.

Doing this allowed agents to feel some agency in their activities, because they could personalize responses to their liking, keeping their personality. The UX team learned firsthand how important it is to design within this framework so that human-AI collaboration doesn't lose those elements that provide agency and satisfaction to service agents.

**Molly Mahar** is a Senior Product Designer at Salesforce and design lead for Einstein Bots, a product offering that leverages AI and chatbots to help support centers manage and grow their operations at scale. Her work focuses on making AI and machine learning understandable and usable by non-technical audiences. *m.mahar@salesforce.com*

**Gregory A. Bennett** is Lead User Researcher at Salesforce for Service Cloud Einstein, a suite of products that leverage conversational AI to benefit support centers and their agents. As a formally trained linguist, his research focuses on empowering businesses to design conversations that feel natural and helpful, build user trust, and meet user expectations for linguistic behavior. *gbennett@salesforce.com*

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## The Human Agency Driverless Cars Must Preserve

ELIOT SALANDY BROWN, *ReD Associates*

KATY OSBORN, *ReD Associates*

*In 2016, we set out to understand the future of driverless mobility — and specifically, how a mobility company can build products and services that will optimize the relationships between people and advanced assistive systems in an increasingly automated future. This case study will shed light on how an ethnographic approach inspired by actor-network theory allowed us to look closely at human-system interactions, build a unique perspective on the forms of agency people value most, and understand how mobility companies can harness this understanding to build automated systems that strengthen their relationships with consumers.*

*Drawing from the core tenets of actor-network theory, our research placed an emphasis not on individuals or even broader social ecologies — but rather, shifting networks of relationships between humans, objects, ideas, and processes. We divided our resources between two research tracks: i) human mobility, studying the complex network of relationships that gives shape to it, and ii) technology, studying networks of relationships surrounding six analogous advanced assistive technologies that are likely to prove pre-cursors to the relationship between people and driverless cars, ranging from the DaVinci surgical robot to the driverless tractor. While the objective of the former track was to understand the relationship between human agency and mobility, the latter was designed to help us understand how advanced assistive technologies might aid or impede this relationship going forward.*

*Studying human-system interactions within broader, complex networks allowed us to uncover an insight about agency that is core to how mobility companies should approach automation. Agency doesn't have a single, fixed value to individuals; rather, people derive greater meaning from and thus value agency over higher-order tasks and responsibilities — often revolving around role determination and fulfillment, such as “being a good father” or “being a precision farmer” — much more than they enjoy and value agency over lower-order tasks — like paying the household bills, or keeping track of contracts with farm suppliers. The people studied aspired to preserve their enjoyable agency over higher-order tasks, and thus perceived automation as most helpful when it liberated them to higher-order responsibilities by removing the burden of lower-order ones.*

*This understanding allowed us to see that mobility companies can reframe mobility as much more than about getting between destinations. Instead, they should see mobility as a broader and more valuable system within which automation can be used to lessen users' burden of control over lower-order tasks, while augmenting people's agency over the most meaningful tasks. This could mean, for example, using automation to remove the lower-order task of navigation, so drivers can focus on curating a unique set of destinations through a city for their passengers; or removing pain points around parking that might dissuade a driver from driving to see a friend, so drivers can focus on higher-order social tasks like setting the mood for a great dinner. Since this study, this focus on unlocking the higher-order value of mobility has become a part of our client company's approach to driverless cars and advanced automated systems. This case study will invite social scientists to consider how we might refine and continue to apply this actor-network inspired approach to build an even more granular ambition for the future of automation in mobility.*

## INTRODUCTION

In 2016, ReD Associates was commissioned by an automotive client — we'll refer to them to as "A Auto" going forward — who recognized the potential of an anthropological approach to help them solve a conundrum: What value could they deliver to people through driverless vehicles? This case study will shed light on how we built a perspective on the experiences and forms of agency people value most in a context where automation has the ability to take tasks off people's plates. Our use of actor-network theory as an analytic frame helped us to distinguish between the types of tasks people wish to have automated and those they may wish to continue to perform, and how to let users have agency even when tasks are being automated.

## BACKGROUND

Of the many transformative technologies crowding today's airwaves, driverless vehicles are arguably being touted as one of the most transformative, predicted to change the auto industry, how people move, and our experience of the urban environment. They are likely to become one of the next major digital platforms, like the smartphone, on which a raft of new integrated services will be offered to people powered by personal data and connectivity. This belief has fueled and been fueled by massive new investments, like Google's self-driving car project which began in 2009. By the mid 2010s, competitors ranged from established automakers to new entrants like Tesla to tech giants like Apple, to mobility service companies like Uber.

Until 2016, most of these competitors had been busying themselves with the complex engineering challenge of developing the hardware necessary for a car to drive itself without human intervention on any road in any condition. But "A Auto" was keen to explore what driverless cars could do for people after that had been achieved. Most driverless car competitors could agree that taking the driver out of the driving equation would result in safer, more efficient, more predictable and cheaper journeys from A to B (Reiner et al 2015). But "A Auto" wanted to explore more fundamental, higher value benefits of AV — once people are relieved of the task of driving what new valuable activities and experiences could be offered in its place, and what challenges of living in cities might driverless cars be able to alleviate? In order to deliver on their promise to do really big things for people that went beyond getting from point A to B, they approached ReD for a human perspective on the experiences that would make driverless vehicles meaningful to people, families, communities, and cities.

This is not the first piece of ethnographic research of its kind. It adds to a conversation started in previous EPIC work on mobility and autonomous vehicles — such as Stayton, Cefkin, and Zhang's research on autonomous vehicles at Nissan (2017) — contributing an argument as to how mobility companies can begin to segment and prioritize tasks for automation. The authors of this paper believe that we need to understand how outsourcing human agency can impact core roles associated with an individual's identity. An ethnographic toolkit is helpful for understanding how people can still feel purpose and relevance when the future is increasingly providing more limited opportunities to signal and express a core aspect of humanness—intelligence and agency.

In the following pages, this case study will shed light on the unique methods we employed in our ethnographic work with “Auto A” that allowed ReD Associates to look closely at people’s relationships to mobility and automation through the lens of helpful relationships to both people and things. Recognizing the utility of objects within peopled networks is a unique proposition of actor-network theory. We used it innovatively as a point of analysis for our study to understand how non-human objects (both with and without autonomous capabilities) contribute to an individuals’ goals that go beyond accomplishing daily tasks. That is, how does technology help someone become better in their myriad roles as caretaker, entrepreneur, or adviser? Our answers to this question helped us develop a framework that allowed “Auto A” to distinguish between roles that users wanted to maintain agency over and why it was important to do so. We then highlight specific challenges and recommendations for researchers that broadly apply to practitioners within the autonomous vehicle space and those struggling to define value propositions that are hazy and unimpactful.

## **RESEARCH**

ReD Associates has been working with this automotive client for a number of years, which was long enough to have established some appetite for a social science-based research approach within the company. Not having to start from a place of fighting for the validity of a social science-based approach set the ReD team up to gain approval for an ethnographic approach.

The insights that “A Auto” needed in order to push forward in autonomous vehicles — insights into what value automation might bring to the mobility space, and how it should show up —are difficult to elicit using surveys, focus groups, or interviews. Ethnography, in contrast, allows researchers to take a holistic, hypothesis-free look at people’s lives; be exposed to the full range of needs, challenges, and aspirations that might be relevant for innovators; and observe hierarchies of value and meaning in action. The simultaneous breadth and thoroughness of an ethnographic approach nicely mirrors the virtually infinite list of valuable experiences that might take place in a driverless vehicle. More importantly, it offers unique potential for narrowing this list down.

ReD’s strategy for taking on the challenge of observing the future in the present was fourfold.

### **Selecting a broad research phenomenon**

ReD projects start with the selection of a core research phenomenon. It differs from traditional scoping because we attempt to ground the project in something that is observable every day—and therefore a core element of human experience. We selected “the helpful relationship” as the study’s core research phenomenon because of the potential for assistive devices to upend a universal and ubiquitous role. By studying what people in everyday situations experienced as helpful and the nature of their relationship to the things or actors that were helping them, we hoped to answer two core questions —what and a how. What sort of help would people value from autonomous vehicles? And how should that sort of help be delivered? (Help, in this case, could come in the form of addressing a problem, or enhancing or delivering a valuable experience.)

Framing the project as a phenomenon drastically widened the team's possibilities for observation: While they couldn't observe the habituated use of a driverless car within respondents' everyday contexts, they could observe the wide range of needs that driverless cars could eventually deliver on. The team could also observe the habituated, in-context use of more common, analogous technologies that provide help — such as a family's in-home interactions with Alexa, or with a vehicle's automated parking features. What's more, they were able to study helpful relationships beyond those with technology — considering, for example, carpooling systems; interactions with personal assistants; or forms of assistance exchanged between family members and friends. The last benefit of studying a phenomenon as spacious as “the helpful relationship” is that it allowed the team to get beyond the hypotheses and biases built into existing technologies, and open the client up to new forms of value they might strive to inject into consumers' lives.

## Dual research tracks

“The helpful relationship” was studied through two main research tracks — human mobility and technology — mirroring these two core research questions roughly (but not exactly). Designing the research in this way allowed the research team to carry out ethnography that was more conducive to success in this project insofar as it i) ensured coverage around both what value driverless vehicles should deliver and how, and ii) allowed the team to observe a range of “helpful relationships,” from more mainstream to more marginal and cutting edge.

*Human mobility* – In the first research track, human mobility, researchers sought to answer questions like: What is the role of the vehicle in people's lives today? What is the role of mobility? What is it that people are ‘connecting’ when they make use of mobility solutions? What forms of help and value do people experience as they move amongst the settings of their day-to-day lives? And: What unmet needs and aspirations remain? The hope was that this track would primarily shed light on what sort of help people might value from autonomous vehicles.

Relying heavily on ethnographic interview and observation (including ride-alongs), the researchers spent 1-2 days embedded in the everyday lives of people across five global cities selected on a spectrum from advanced mobility infrastructure to basic mobility infrastructure. Each researcher was tasked with gaining an in-depth understanding of not just one core respondent, but of their day-to-day relationships to mobility, technology, and broader social ecologies. Over the course of five weeks, the project team met with 32 respondents and 5 fleet vehicle systems (businesses that use multiple vehicles as part of daily operations). (While the project's initial research plan also included ride-alongs in driverless vehicles on the client's testing grounds, this was ultimately excluded from the study for logistical reasons.)

*Proxy technologies* – It was the second research track — technology — where the team was able to most freely explore and unpack the how aspect of “the helpful relationship.” How should help from autonomous vehicles be delivered?

This second research track brings us to a third aspect of the team's approach, - observing people's relationships with already existing proxy technologies. Looking to the world's most advanced and embedded assistive systems, the goal of this research track was

to understand the complex interplay between people, advanced assistive systems, and ideas that makes these systems successful or not; and to extract principles that could be applied to autonomous vehicles. They sought to investigate questions such as: What is the user experience of interacting with an advanced assistive system? How do people experience help from automation? When does automation bring value to their lives, and when does it cause resistance? Where do people wish they received more help?

This research track centered around seven half-to-full-day immersive deep dives in which the researchers could observe the relationship between practitioners and advanced assistive technologies. Visiting sites across four global markets, the team was able to observe interactions with the Da Vinci surgical system, the John Deere autonomous farming system, Disney World's MyMagic+ smart pass system, a Boeing Autopilot Flight Training Simulator, the Roomba vacuuming system, a machine-learning-powered vial filling assembly line in a pharmaceutical factory, and an experimental digital system that puts computer algorithms at the center of the industrial design process.

### **Drawing inspiration from actor-network theory**

The team employed an approach inspired by actor-network theory. The hope was that understanding and mapping out relationships between humans as well as humans and technologies would help produce insights that could be used to optimize the relationship between people and driverless vehicles, and perhaps even the relationships between driverless vehicles. For each of the proxy technology studies, as well as key helpful relationships and systems observed, the researchers went through a process of asking and mapping: What does the system do? Who and what is involved? What flows of information and activity can we observe? And: what makes these 'flows' successful or unsuccessful?

### **Triangulating with existing perspectives**

Finally, field research was triangulated with existing perspectives on the future of automation and autonomous vehicles through a combination of desk research and interviews with over 25 analogous systems experts, human science thinkers, and user experience and design practitioners. These interviews proved invaluable to the team in understanding existing assumptions and orthodoxies around the future of automation, as well as both mainstream and marginal narratives on the what and how of autonomous vehicles' potential future value.

## **KEY FINDINGS AND TAKEAWAYS**

We exist in a cultural moment when the boundaries of automation are undefined. Many discourses overlook human agency entirely, promising that "intelligence" will in time infiltrate just about every aspect of human life — from how we cook and shop, to how we date, work, create, travel from A to B, and much more.

Perhaps the greatest victory of this project was that the insights delivered to "A Auto" shifted the emphasis from where automation *can* play a role to where it *should*. At the core of these insights was a model that outlines the three universal, high-level needs that people have around experiencing meaning and value in their lives, and clarifies the relationship between these needs, technology, and mobility. This model helped "A Auto" get closer to answering



the what component of this project's research mandate — What sort of help would people value from autonomous vehicles? — narrowing in on three 'domains of value' within which to conduct further research and innovate. It has since become a key component to how "A Auto" seeks to deliver value to its consumers in and beyond its automation efforts, and is used frequently in departments as disparate as branding and service development.

While this universal model cannot be disclosed in this case study for confidentiality reasons, this case study will disclose a secondary component of the insights: three universal principles for developing valuable and agency-aware automation. These principles touch at a high level on both the what and the how of the project's research mandate: what roles assistive systems should and should not take on in the mobility space and beyond, and how they should behave.

### **Not all tasks should be automated**

While this universal model cannot be disclosed in this case study for confidentiality reasons, this case study will disclose a secondary component of the insights: three universal principles for developing valuable and agency-aware automation. These principles touch at a high level on both the what and the how of the project's research mandate: what roles assistive systems should and should not take on in the mobility space and beyond, and how they should behave. Whether studying precision farmers, pilots, or surgeons, ReD observed that there's a certain realm of human activity in which automation is unwelcome, and another realm in which it's very welcome if done right. Agency doesn't have a single, fixed value to individuals. People are often more than happy for automation to take over more logistical, tactical tasks that are experienced as tedious or menial — "low-level tasks" — and particularly those seemingly unrelated to the high-level roles and goals people aspire to fulfill. In contrast, they tend to resist automation that attempts to take over "high-level responsibilities:" more strategic, big picture; curation, decision-making, and execution — often around fulfilling certain roles or goals, such as "being a good father" or "running a sustainable more farm."

Low-level tasks are fairly easy to spot. For the precision farmer, a low-level task might be calculating the right amount of fertilizer to order from a distributor, or predicting how many days you will need a piece of rental equipment given a certain planting cycle. For a father, a low-level task might be doing the family taxes, or planning, cooking, and packing kid lunches for the week.

In the case of low-level tasks, the value of automation often trumps the value of agency. In general, people derive very little meaning, fulfillment, or enrichment from carrying out true low-level tasks — they tend to find them burdensome distractions from the high-level tasks that matter most to them. These are the tasks that automation can more or less remove from people's plates, and where tech can reasonably be expected to show up with credible solutions in the next decade without too much of a capability stretch.

High-level responsibilities can be less easy to spot without a holistic lens: they are often highly individual and contextual, and lack clear markers for completion or success. For the new retiree, a higher-order responsibility might be feeling fulfilled after a career has ended by strengthening existing relationships. For an overworked manager, it might be ensuring time for self-care and relaxation. For someone who has recently moved, it might be making new friends by starting new hobbies.

In any case, people are completely and unequivocally demanding agency over these high-level responsibilities, as well as the decisions and behaviors that seem to directly support them. Not only do these higher-order responsibilities provide an opportunity to engage in strategic, big picture decision-making, but success is often highly meaningful. Succeeding in higher-order tasks can help someone connect to or strengthen their identity, or attain value in the form of pleasure, mastery, status, or personal enrichment. Humans, objects, ideas, or processes that get in the way of people engaging with these high-level responsibilities are getting in the way of all the forms of fulfillment and meaning they potentially offer. This is the form of human agency automation must preserve.

One key exception to this framework is when a task that may appear low-level is actually directly tied to a much higher-level responsibility in a person's life, and thus becomes a task in which it people see value in investing hands-on time and energy. Cooking might be considered "low-level" to a busy working mother who is primarily concerned with being a better friend, family member, and entrepreneur; but the task may in fact feel quite "high-level" to an aspiring chef, an avid host, or someone who sees cooking as a means to the more grounded and relaxed life they desire.

It is not a new idea that tactical, routine tasks will be the first to be automated. But the reason to not automate strategic, higher-order tasks has historically been about the limitations of technology. Recently, the narrative around the value of automation has increasingly set its sights on the automation of higher-order tasks as a way of bringing value to consumers. This work challenges that ambition. Doing so may be technologically possible, but we would argue that in many cases it will not be experienced as particularly desirable or helpful.

### **Automation should always allow people to retain a sense of overview and control**

When delivering help with these low-level tasks, automation must be executed in such a way such that the user always retains both overview and control. ReD observed that when advanced assistance systems removed users' ability to understand, oversee, and even toggle or intervene in the automation process — disrupting their pulse on when automation was happening, what it was doing, and why — they felt these systems had gone too far. This experience left them feeling vulnerable, and helpless against a hypothetical situation wherein they needed to step in, make a change, or leverage information around a low-level task to course correct within a high-level one. The surgical pilot studied by ReD highlighted this fear of helplessness, saying: "If the system makes a mistake and I can't quickly get an overview, I can't intervene." The precision farmer expressed a similar desire to feel like the central control hub of an automated system, saying: "I want a system that puts me at the core."

Providing overview and control is not only important because of how it makes people feel; it's also critical for ensuring that automation does not result in their deskilling. When people do not have overview and control over low-level processes — because of automation or otherwise — these processes become a black box to them, and impede the sort of big-picture thinking needed to carry out high-level responsibilities like strategy and curation. In contrast, when automated systems collect, organize, and communicate data that provides people with a sense of overview and control over low-level processes, they can augment the

sense of agency and expertise people bring to carrying out their high-level roles and responsibilities

### **Automated system interfaces should make the limits of their capabilities clear**

The third and final principle ascertained by the ReD team is around how automated systems should communicate with their users. In short, anthropomorphism is not the answer. This study and countless others conducted by ReD have surfaced endless moments of people struggling with voice assistance technologies, frustrated by the gap between the expectations conjured up by an anthropomorphic interface and the reality of its lackluster performance. People are frequently raising their voices, cursing, making fun of, trying to subvert and outsmart, and sometimes ultimately dismissing anthropomorphic technologies — from automated customer service systems to Alexa and Google Home to in-car navigation systems. Despite this, UX conversations around how advanced assistive technologies should feel almost always draw upon a suite of possible personas. Should it feel like a partner? A wise council? A friend? A servant?

Embedded in these conversations is an assumption that it's a human relationship people seek when they interface with robots. In fact, the people ReD studied would rather carry out “dumb” or repetitive interactions with an interface whose capabilities were limited but clearly defined than have natural, smart, or varied interactions with an anthropomorphized interface like Siri that does not make the boundaries of its capabilities clear — and thus, is liable to disappoint. This study suggested engaging with automated systems should feel less like interacting with a human and more like interacting with a dog. People know what their dogs are trained to do, and have a limited set of fixed commands — almost like verbal buttons — they can employ to activate these behaviors. The result is that people feel a relative sense of overview and control — an in turn, a stronger sense of agency.

## **REFLECTIONS ON RESEARCH AND IMPACT**

Research is inevitably different in theory than in practice. In the case of this study, the team's China researcher was briefly detained outside of Chengdu when his investigation into “how people live” was deemed suspicious. In Munich, a terrorist shooting in a shopping mall resulted in the team's Germany researcher hosting a temporarily displaced client in his Airbnb for the night. Upon arriving at a house in Dallas, another researcher was reminded that autonomous vehicles will inevitably play a role in underground economies — including the one responsible for furnishing this particular home with piles of drugs and cash.

More pertinently, there were methodological challenges. The most significant of these had to do with the broad scoping of the research, and in particular, the question: What sort of help would people most value from automation in the mobility space?

In theory, almost any valuable task from normal life could reasonably be transported to the interior of a driverless vehicle, just as new mobility solutions could realistically connect people to just about any valuable experience. This reality altered what the research team originally thought was a reasonably focused research question — What sort of help would people most value from automation in the mobility space? — into one that was almost impossibly large. The challenge it introduced during research was that no observation was obviously out of scope: researchers had to be ultra-alert, attuned to every last need and

aspiration in the event that they might — in conversation with those observed by other researchers — be core to identifying a fundamental value proposition for autonomous vehicles.

While challenging, this level of breadth was not ultimately insurmountable. This level of breadth did, however, mean that both the universal needs model and automation principles ReD developed for “A Auto” were very high-level, and in some instances ultimately difficult for the client to translate into concrete experiential solutions. There’s a strong case to be made that a more iterative approach to ethnographic research — conducting several weeks of research to arrive at the big idea, and then returning to the field to flesh out subthemes and collect more granular data — could have helped avoid this difficulty with translation. As it stood, this project ended with ReD and “A Auto” having identified clear domains of value around mobility and automation. The logical next step would have been to make these domains of value prescriptive, using additional granularity from the field to define clear principles to follow and key levers to pull within each domain.

Another notable challenge was in layering actor-network theory onto the team’s ethnographic research and analysis. Initially, the ReD team set out to map out the networks of humans, objects, ideas, and processes observed in the field, and to use these maps to analyze key relationships and dynamics. But applying actor-network theory requires an analytical jump whereby humans, objects, ideas, and processes are all given equal weight, and display behaviors and states — including success and failure states — that can be described using consistent language. While the team found it fairly intuitive to anthropomorphize automated systems — describing the Da Vinci surgical robot as intrusive or socially inept, for example — describing the behaviors of concepts and processes in common terms proved much more difficult.

The result is that the network maps that came out of this project looked more like behavioral maps, or maps of systems: They were very logistical, practical, and did not include ideas as agents. This is not to say that the outcomes of the study were greatly diminished. The systematic lens provided by actor-network theory remained helpful insofar as it illuminated mobility systems that “A Auto” could potentially own in the future, as well as connections they could make to other systems through partnerships (e.g. retail networks). However, a more rigorous application of actor-network theory — and particularly one that places greater emphasis on ideas as agents — could potentially open up new possibilities in future technology studies. Understanding the ideas that surround people’s helpful or unhelpful relationships with technology, for example, might surface implications for branding and storytelling.

The third point to be made is not around a challenge so much as an area for methodological growth. ReD’s more recent exploration of proxy technology assessments in its methodology has begun to highlight how fruitful it might have been to study mobility settings analogous to the driverless vehicle that could stand in as proxies — for example: taxis; shared second-order mobility experiences like Uber Pool; or contexts like carpooling systems, in which the driverless experience is orchestrated through a social exchange. Expanding the research to include these proxy sites would have helped the research team to establish a stronger foundational understanding of the default behaviors and higher-value experiences present in existing driverless mobility contexts, and more clearly articulate how future contexts might offer a departure.

Fourth, despite our continued work with “Auto A” there were a number of conceptual jumps they needed to make that involved getting outside of the engineering and design domains they traditionally work in. It’s worth noting that this is not an easy mandate. Picture a driver, sitting in his or her car. Now imagine that this driver no longer has to drive the car. This means that the car no longer needs a forward-facing driver seat. In fact, the inside of the car no longer has to look the way it previously did at all. And suddenly, this driver could be doing any number of things as that vehicle moves towards its destination: sleeping, working, exercising, bonding, meditating, playing video games, shopping, cooking, eating, watching tv, listening to a podcast, reading a book, learning, hosting a meeting — the list goes on. Each of these new use cases stands to change how people evaluate and choose between mobility options — and thus, the types of journeys for which a vehicle might be used; the types of experiences to which a vehicle might connect people; and ultimately, the forms of value a vehicle delivers in people’s lives.

“A Auto” also faces an additional challenge beyond understanding the value of autonomous vehicles. The digital age increasingly asks companies that have historically excelled at manufacturing to compete for a position much higher up in the value chain — delivering not just physical products; but the layers of services and experiences that can now be built on top of them, delivering margins previously unobtainable to manufacturing companies. Competition is no longer happening exclusively on the factory floor, so much as in the design rooms of companies like Apple; where a wealth of experience, instincts, and data is harnessed to connect with, engage, and deliver value to consumers in unprecedented ways.

At the time of this project, a bold subset of voices within “A Auto” had the vision to recognize a shift in the modus operandi of companies like them, and were beginning to advocate for the company’s own internal shift towards building services and experiences. There wasn’t a strong consensus around exactly how to drive this shift— should the consumer perspective be the domain of a growing UX department? An advanced design department? Consumer insights? But there was consensus that it was critical for “A Auto” to invest in developing its own deep understanding of — and instincts around — the mobility experiences that consumers would value most, and build a value proposition for autonomous vehicles rooted in this understanding. This consensus came from the flourishing of a culture of focusing on the customer as an antidote to a growing awareness that many automotive innovations from the past ten years had not delighted customers in the way engineers had hoped. Enlisting help from ReD was one of the first instances that these voices were able to break through to the powers that be — from the head of engineering to the head of strategy to the CEO — and get them aligned around a single agenda point.

## CONCLUSION

If technology refers to “the art, skill, ... way, manner or means by which a thing is gained,” ethnographic research is today a technology as valuable as any. In a landscape where a suite of emerging technologies is predicted to radically alter the way people live, ethnography can help companies to refine their expectations — recognizing the universal human needs, aspirations, and forms of agency amongst which the value of various technologies is determined. More importantly, it can illuminate a path forward for

companies where meaningful experiences trump the novel and high-tech. With some refinement, an ethnographic approach informed by actor-network theory can potentially take this value a step further, helping companies take a more holistic approach to driving value through new forms of automation — going beyond systems design to consider for example the language, storytelling, and interface aspects that can affect the success of an assistive technology.

For “A Auto”, an ethnographic approach to the challenge of creating value in autonomous vehicles highlighted key domains of value in which “A Auto” should concentrate its efforts, as well as key initial principles for doing so. Automate low-level tasks while preserving or even augmenting agency over high-level, strategic ones; Allow people to keep a sense of overview and control over any automation; Avoid anthropomorphic interfaces.

These principles add up to a few key statements about human agency in an age of automation. First, agency is variable in value depending on the task at hand and how this task fits into people’s higher-level goals and roles. Second, even where agency holds little value for people, they are highly sensitive to its removal, and expect to be kept ‘in the loop’ enough that they have the ability to reassert agency at any point in time. And third, agency means no surprises — and people experience automation that acts smarter than it turns out to be as a highly unpleasant surprise.

The limits of this study’s impact highlight the value of iteration in ethnography, as well as yet unexplored possibilities of proxy technology assessments and actor-network theory more rigorously applied. But more than anything, they point to ripe territory for methodological exploration and refinement — and within this territory, the rich opportunity for ethnographers to help shape an automated future that enhances and augments human agency, in and beyond the vehicle. Despite our focus on autonomous vehicles, the hope is that this study will offer a building block — both for companies looking to establish meaningful value propositions for emerging technologies, and for ethnographers looking to push forward their methods of studying them.

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## Using Ethnography and Narrative Analysis to Uncover Customer Agency Intrepid Travel's Online Booking Project

ALICE WATSON, *Intrepid Group*

*This paper draws on a discovery research project focused on the customer experience of Intrepid Travel's automated booking system. The Data Analytics team initially investigated customer behaviour when booking and found problems with high exit rates on the first and second steps of the 3-step booking process. A paradox was also found between the numeric NPS and CES scores for booking, and comments which revealed high volumes of customers requiring assistance from customer service to complete their online booking. The Product Manager for this project prioritised an extended discovery research phase to provide a more holistic understanding of the customer experience of online booking and answer some questions that arose from customer behaviours highlighted by the Data Analytics team. The UX Researcher's task was to design a research project that would analyse why customers were struggling to complete Intrepid Travel's automated booking process and provide recommendations to improve this system for a better customer experience.*

*The UX Researcher designed a qualitative research project with an ethnographic approach, which aimed to provide a detailed understanding of customer experience of Intrepid Travel's automated booking system. The project involved real customers completing actual online bookings, with participants from Australia, North America and Europe having their face, screen and voice being recorded in discussion with a moderator. These usability sessions highlighted customer's experience of decision-making, especially how the design of the booking system impacted a customer's sense of confidence, clarity and control. Ultimately, the results from this study demonstrated that Intrepid Travel's automated booking system negatively impacted customer's sense of agency in relation to their booking. The design and functionality of the choices presented to customers removed their ability to make decisions independently and instead caused confusion and a feeling of loss of control for customers. Using real customers who were engaged emotionally and psychologically with the booking process was crucial in uncovering agency as a causal factor in a negative customer experience with Intrepid Travel's booking system.*

*These details of the customer experience were highlighted in collaborative workshops with stakeholders and the product team facilitated by the UX Researcher. Two synthesis and analysis workshops were conducted with the aim of bringing stakeholders closer to the customer experience and engaging them directly with customer research. The Narrative Analysis workshop especially was impactful in drawing out customer's tacit needs, highlighting customer agency as integral to positive engagement with an automated system. Both collaborative workshops were successful in engaging stakeholders in how online systems can fundamentally impact customers emotionally and psychologically and pushing the customer journey beyond highlighting 'pain points' to solve with design.*

*This case study demonstrates the value of digital ethnography in uncovering how an automated system impacted Intrepid customer's ability to maintain agency in decision-making when booking a trip online. This research uncovered significant design problems and the findings created a platform for UX design principles that ensure that redevelopment of Travel's online booking system centres on customer agency.*

## COMPLEXITIES WITH ONLINE BOOKING

Intrepid Travel is an Australian adventure travel company which operates small group tours on all continents, providing customers with sustainable, experience-rich travel. The company started 30 years ago as a start-up initiative by two friends and has expanded since then, while keeping responsible tourism, a love for adventure and innovation at its core. Booking customers onto trips is the essence of Intrepid Travel's business. However, in 2018 70% of customers in the Asia-Pacific region were still booking through travel agents, rather than through the online booking system available on the website. With costs of commission to travel agents high, the effort of maintaining ongoing business relationships with travel agents and uncertainty in the travel retail space, there was a growing push within the leadership at Intrepid Travel to move customers onto direct booking channels. The potential return on investment that could be realised by shifting more customers in APAC, and globally to online booking prioritised a project that sought to optimise Intrepid Travel's online booking system.

To start the Direct Sales Optimisation Project, the Data Analytics team began with understanding overarching customer behavioural trends between clicking the 'book' button on the trip a customer has selected, completing the three-step online booking system and the email journey between confirming booking and departure on a trip. They discovered that between January 2017 and August 2017, of the 138,000 customers that click through from the 'book' button to the first page of the booking process, only 15,000 fully completed their booking; approximately 11%.

The Analytics team also looked at the 'exit survey' which popped up when customers clicked 'back' or exit on the browser during the booking process. Customers could answer a free text field in response to the question: 'what prevented you from booking online today', providing insight into the reason they were abandoning the booking. The comments from this field were analysed by text volume and trends revealed that many customers identified flights, room options and payment as causing them to abandon the booking process entirely. Despite this text volume analysis, it remained unclear why these particular topics were triggering an exit response from customers.

NPS and CES data linked to online booking demonstrated high numerical scores, however only reflected customers who fully completed their booking online. The comment content highlighted issues with email communications from Intrepid Travel post-booking and technical problems with the automated booking system that were resolved through a positive customer service experience. The comment content added complexity to the high numerical scores and raised further questions about the overall context of customer experience and satisfaction with online booking. The data from NPS and CES therefore was inadequate in providing a full picture of the customer experience of online booking and could not account for the experiences of potential customers who dropped out of the booking process.

A significant knowledge gap also existed for those within the company in understanding the customer experience and perceptions of email communications from Intrepid Travel between booking their trip and departing. Despite many people working on emails that were customer facing, there was a lack of accurate documentation, significant issues with siloing between departments, regions and software operating systems that emails were being sent from and no understanding of how this was affecting the customer's experience of



preparation for their trip. There was also no quantitative or qualitative data being collected on the email journey between booking and departure, presenting an issue in benchmarking the current state or proving any guiding metrics for understanding the customer experience of email communications in this important part of their customer journey.

Before re-design of the online booking system started, the Product Manager prioritised a discovery research phase as necessary to better understand the customer experience of online booking. These initial investigations by the Data Analytics team highlighted key knowledge gaps for further focus: what was triggering customers to abandon the booking process at high rates, and why customers were contacting customer service while booking online. Discovery research on customer's perspective on email communications between booking and departure were also scoped for this project. The UX researcher decided that an ethnographic approach would provide clarity and detail about the customer experience and fill these knowledge gaps. This qualitative research was positioned to provide insight into the context of customers struggling to complete bookings online and create findings that were actionable for developing an improved online booking system.

## **ETHNOGRAPHY AS A 'WHY' METHODOLOGY**

The discovery research study design involved qualitative methodology: A diary study and usability sessions, aimed at capturing a holistic understanding of the customer's online booking experience from clicking 'book' on the Intrepid website to departure on their trip. The overall objective of this methodology was to provide detailed insight into why customers were struggling to complete an online booking in surprising volumes.

Usability sessions were designed to answer the overarching question 'how is the 'booking' stage of the customer journey being impacted by Intrepid Travel's automated booking system?'. The longitudinal diary study aimed at capturing customer's perspective on email communications from Intrepid Travel from the time of booking through to departure on their trip. Key research questions for the diary study were 'what are customer's information needs between completing a booking and departing on their trip?' and 'are email communications from Intrepid Group preparing customers for their trip in a way that meets customer's expectations?'. Both inductive methodologies would complement each other in providing focus, depth and detail into the customer experience from their own perspective and uncover key factors to be improved by a redesign of an online booking system and email journey.

This case study focuses on the usability study component of the research as this highlighted agency as a causal factor in customer's problematic engagement with the online booking system. Usability sessions were a methodology that proved critical in capturing insights on the customer's emotional and psychological engagement with the online booking system.

The usability component collected insights from 21 participants from Australia, North America States and Europe. Each participant had their screen, face and voice recorded during moderated usability sessions while they made an online booking for an Intrepid Travel trip. Data collection responsibilities were split regionally, with the UX researcher conducting usability sessions for Australia, and two non-researchers conducting usability sessions from London and California in their respective regions. To assist non-researchers in this role of data collection, training and resources were created by the UX researcher.

The UX researcher also provided a table of metrics (Figure 1.) to assist the non-researchers conducting usability sessions to understand what they should be looking for in those sessions and help them to conceptualise the 'data' that was pertinent to this project's aims. This was helpful in framing the study as including participant's emotional and psychological engagement with the online booking system alongside looking at usability and functionality.

Providing this table of metrics and training and ongoing mentorship of regional non-researchers was essential in emphasising the ethnographic approach of the project design and capturing the contextual data of customers making a real booking, as well as the details of them using the online system.

## **Global Research with Non-Researchers**

The discovery research phase was scoped to understand the customer experience of booking online across all of Intrepid Travel's key global sales regions: Asia-Pacific, Europe and North America. Given that there is only one UX Researcher, and no other staff in a role that includes qualitative research, this global scope presented a significant challenge.

Scaling this project therefore involved using staff from other departments to work as proxy researchers that could collect data from Europe and North America. A marketing manager from California and a marketing executive from London were trained and resourced by the UX researcher to moderate usability sessions with customers in their regions independently. Using local staff to engage with customers in their own regions was advantageous to understanding regional nuances such as date and address fields in the passenger details section of the booking form, and different language and cultural expressions when discussing travel, payment and communication or customer service needs. Working across different time-zones was also made easier by having a localised moderator for usability sessions.

Working with staff from different departments and in regional offices was an opportunity to involve the wider business in UX research and bring others closer to one aspect of the customer experience. It presented a steep learning curve for the UX Researcher in being able to effectively and concisely communicate the essential information for the role of moderating usability sessions, best practice for qualitative research and an ethnographic approach in a limited time, with inexperienced individuals. The resources created to train and mentor the moderators for this project, have since been used to instruct other people in the company interested in being involved in UX research. This project has been a benchmark in democratising UX Research praxis, which has opened all stages of data collection and analysis to be inclusive of stakeholders. Projects since have involved non-researchers in moderating, note-taking, observing and synthesising data which has resulted in increased buy-in and interest in UX Research across Intrepid Travel. The value of good quality qualitative research and the insight it provides to business problems has also been recognised and acknowledged in regions outside of the Head Office in Melbourne, which has resulted in more demand for data-driven decisions. The learnings from the global scale of this project came from the challenges of conducting ethnographic research praxis with inexperienced researchers, but seeing reward from the results.

<b>What the researcher is looking for</b>	<b>What the participant is doing</b>	<b>How the researcher collects this information</b>
Usability	<ul style="list-style-type: none"> <li>· Completing all fields</li> <li>· Understanding the UX copy</li> <li>· Understanding what is required with selecting options</li> <li>· Understanding what is required to move to next page</li> <li>· Can find information they need</li> <li>· Can access help if required</li> <li>· Can access booking information</li> </ul>	<ul style="list-style-type: none"> <li>· Watching screen</li> <li>· Asking if information is clear</li> <li>· Asking where they expect to find information</li> <li>· Asking where they would access help</li> </ul>
Emotional Engagement	<ul style="list-style-type: none"> <li>· Explaining why they chose this trip</li> <li>· Checking information for right trip</li> <li>· Checking departure dates</li> <li>· Checking personal information is entered correctly</li> <li>· Able to find information they need</li> <li>· Expression of comfort/ discomfort in providing information</li> <li>· Expression of security/ insecurity with payment</li> <li>· Checking payment confirmation</li> </ul>	<ul style="list-style-type: none"> <li>· Watching screen</li> <li>· Watching their face – where their eyes are looking.</li> <li>· Scrolling up and back to ‘check’</li> <li>· Asking about security and comfort</li> <li>· Asking how they ‘feel’ during the process.</li> </ul>
User Behaviour	<ul style="list-style-type: none"> <li>· HOW they:</li> <li>· Look for information (engagement with search bar, tabs, filters)</li> <li>· Choice of room type, extras, TIF, payment</li> <li>· Expectations of emails following booking</li> </ul>	<ul style="list-style-type: none"> <li>· Watching screen</li> <li>· Asking about their choices</li> <li>· Asking about email expectations</li> </ul>
Desires	<ul style="list-style-type: none"> <li>· Saying what they were expecting that was not provided in the booking experience</li> <li>· Saying what would make their booking experience easier</li> <li>· Saying what needs are unmet by the booking experience</li> <li>· Demonstrating where a certain feature/ function could be</li> </ul>	<ul style="list-style-type: none"> <li>· Asking what their expectations are</li> <li>· Asking if they are looking for a feature/ function</li> <li>· Asking what would improve or assist their experience</li> <li>· Asking about their payment needs/ preferences,</li> <li>· Asking about communication with Intrepid</li> </ul>

Figure 1. Table of metrics for conducting usability sessions

## Researching the ‘Real’ Customer Experience

Capturing real customers completing an actual booking was integral to understand emotional investment, confidence and decision-making when focusing on customer interactions with Intrepid Travel’s automated booking system. To use real customers for this project required a somewhat complicated recruitment process; customers had to be recruited at an opportune window between being ready to book and completing a booking.

Gaining consent from participants was another significant hurdle because the online booking system requires personal information as part of the process; some of which would be captured with screen recording software. The need to establish balance between a desire to fully capture people’s authentic experience with entering personal details into the system, with a need to protect their privacy and be aware of ethical research practice was apparent. A carefully worded consent form explicitly laid out all the details of what was to be included and excluded in the screen recording, who would be able to access the data and how it would be stored securely. Recruitment for this project in the right timing, and with a lengthy consent form, was difficult and returned a high drop-out rate, which strained time-lines and the effort of regional moderators in balancing this project with their usual Marketing roles.

Software called ‘Lookback’ enabled the moderators to capture the booking process, as it records a participant’s screen, face and voice simultaneously, while allowing them to be interviewed at the same time either remotely or in-person. Participants could use their own device, and sessions could be conducted remotely as the software could be easily set up by the participant installing the app or clicking a link with set up prompts. Each usability session took between 30 minutes and an hour. The sessions followed customers through the entire process from clicking on the ‘book’ button on their selected trip, going through each step: entering their passenger details, selecting room type, selecting extra services and donating to The Intrepid Foundation, making a payment (full payment, deposit or hold), and finishing with the booking confirmation page and going through the ‘My Booking’ portal. Throughout this process, the moderator asked them to explain their process, ‘think aloud’, describe their expectations and hesitations and talk through their frustrations.

The project included 21 participants in total, with 9 customers from Australia and 6 customers from North America completing an actual booking while being recorded using Lookback. Data collection from Europe, however, was affected by the difficult recruitment process and using a non-researcher with limited time to spend on recruiting real customers within the project deadlines.

This resulted in the participants from Europe consisting of 6 friends or ‘friends of friends’ which meant they did not have the intention of completing a real booking. The difference between these ‘proxy’ users who stepped through the online process and real customers engaged in the process and outcomes of a booking was stark. The users who were not making an actual booking, gave more comments on the visual design of the booking process, the functionality and copy, rather than the broader context of their expectations, the outcomes of choices and decision-making. These proxy users did not double check their information and were not invested in the rooming or extras options, although some expressed confusion about the display, copy and layout. They moved through the usability sessions quicker and did not go through the payment process, and therefore did not deliberate about the different payment options or their booking or payment being confirmed.

The data collected from the European users was therefore used primarily for closer analysis on system functionality, usability, layout and design as the data on emotional and psychological engagement was not captured with proxy users. The European data was stored with the North American and Australian data but marked as 'usability' data and analysed somewhat separately to the sessions with real customers. The themes emerging using axial thematic coding were different due to the nature of user engagement with the booking system. Thematic coding for the European data did not show significant results for agency, effects on user's confidence or sense control, instead highlighting individual features of functionality and design as the most important for users. Notably, solely using proxy users in the project may have missed agency as a primary causal factor of a problematic customer experience with the booking system.

Proxy users in the UK demonstrated the comparative value of engaging real users in Australia and North America, and the different level of insight when customers were emotionally and psychologically invested in the booking process. The impact of having real customers participate was clear in the results from the data, and the value of maintaining the intended research design is a lesson learned for future UX research projects to keep the data consistent and easily synthesised and analysed. Using real customers instead of 'users' in Australia and North America demonstrating their booking experience pushed the metrics of this project beyond functionality, heuristics and usability and were essential in uncovering agency as a foundational aspect of customer experience with the booking system.

### **Findings from Usability Sessions:**

The overarching insight from observing customers engagement with Intrepid Travel's automated booking system was how the system caused customers confusion, a loss of confidence and a need to clarify or seek further information on decisions that were necessary for booking. Ultimately, customers felt their ability to maintain a sense of agency in independently being able to decide on booking options according to their needs, and in relation to their selected trip was undermined by the design and function of the online booking system. The following is more detailed breakdown of the key insights leading to this conclusion:

The series of choices presented to customers in the online booking process were the most significant pain point. Some choices presented to customers came without warning, were ambiguous and had unclear outcomes: especially room type and extras selection.

(Customer selecting room type) there is no information that clearly says I will be sharing with my sister, it says I will be sharing, but not with the co-passenger, I will call because I am not sure.

As customers proceeded through the booking steps, they lost confidence and trust in the outcomes of their selections and were not sure of what actions would be taken by Intrepid Travel to confirm their room type and any extras they had chosen. This affected customer's agency by making them unable to understand the impact of their choices, and link decisions to outcomes.

Customers felt the need to double check information about their booking at each stage of the booking process, and when this information remained unclear, felt the need to contact

customer service by phone or use live chat to clarify. Their ability to maintain independence when making decisions about their needs regarding their trip was therefore impacted.

Travel industry specific language such as 'on request' and 'single supplement' also caused confusion among customers unfamiliar with travelling. This increased customer's sense of loss of control, confusion and contributed to them losing confidence in ownership of their decisions related to their trip.

Information customers were expecting, ie. pricing when selecting airport transfers, was not available which made them feel out of control of their budget and feel a loss of responsibility for their trip. There was also no information available about how or when the customer could have access to pricing information, if they were responsible for following up, if they were locked-in to a selection or if a quote would be provided as optional, or what the post-booking process was.

(Customer selecting extras) I just want to see how the price changes when I select these options. At this point I am wondering if it will affect my total trip price, because it just says 'to be confirmed'.

On the same page in the second step of the booking process, the customers were confronted with 8 ambiguous choices, the final choice being a donation to The Intrepid Foundation. For most customers participating in the usability sessions, this was the first time they had seen The Intrepid Foundation and so they felt it was just another choice they had limited information on and were again uncertain of the outcome. The choice presented was to donate '2% of their booking price', however a numerical amount was not provided. The cognitive load for the majority of customers at this point was high, which led to them choosing not to donate.

When at the payment stage, customers who started by being ready to fully commit to booking and paying in full or a deposit, chose to place their trip on hold (button option) because they wanted to clarify information they were unsure of by phone or email before paying. Many customers felt that agency over their budget had been affected by not having pricing information if they selected extras, making them feel a loss of control.

Oh this is good - I have the option to place my booking on hold which means I can call and talk to someone before making a payment.

Customer's end goal of booking a trip with confidence, became obscured by the number of ambiguous or confusing choices and outcomes that were part of the decisions necessary to complete the booking process. Intrepid Travel's automated booking system negatively affected customer's ability to maintain their sense of agency in booking the trip of their choice and selecting options relating to their needs.

## **ANALYSIS AND STAKEHOLDER ENGAGEMENT**

The online booking project involved global research and was guided by an ethnographic approach therefore the UX researcher decided that synthesis of the research would have to be inclusive, collaborative and digital in order to maintain the global scale of the project. Collaborative workshops were designed by the UX Researcher with the aim of bringing non-researchers directly into the research synthesis and analysis process, engaging

stakeholders more directly in the customer experience. This was a significant shift from previous practice of the UX researcher working singlehandedly to synthesise data and present conclusions exclusively to the product development team working on the project in sprint. The workshops included Business Analysts, Product Owners, CX Managers, Web Developers, UX Designers, Customer Relationship Managers and Sales Staff and were instrumental in creating buy-in from these stakeholders of customer insights. The workshops enabled each participant to gain a close understanding of the customer experience of the booking system, to contribute their perspective and expertise collaboratively and take responsibility for their role in improving the online booking system for the customer.

### **Thematic Coding with Trello Workshop**

After creating comments from each usability session recording, the UX researcher intended to look for themes and patterns, using axial coding methodology and ascribing manifest and latent themes simultaneously. However, to both save time and take the opportunity to involve non-researchers in research work, the UX researcher decided to code the text data in a collaborative workshop. Participants in the workshop had no previous experience with qualitative coding, so Trello was chosen as a simple and accessible tool to enable collaborative participation and efficient data processing, while still producing usable results.

Trello was utilised as a tool for organising text data from usability sessions and analysing this data using a Grounded Theory approach (Glaser & Strauss 1967). Trello is not expressly built for this purpose, but its comment card, labelling and sticker functionality can be easily adapted to research synthesis in a simple way that everyone can readily understand and use. The UX researcher set up the Trello board so that one list represented a de-identified research participant, and the cards were their transcribed comments and comments about their screen use from their usability session where their booking process was recorded.

During the workshop, each workshop member was assigned one research participant Trello list to work with. Together, each workshop participant familiarised themselves with the customer journey of one customer, spent time reading the comments, understanding the pain points and triggers for action such as wanting to contact customer service. A discussion was then held after this familiarisation process, where workshop participants shared insightful moments in their customer's journey, and themes started to emerge, as workshop participants realised that some 'moments' were similar across different customer journeys. The next phase of the workshop involved workshop participants applying Trello labels as 'codes' both manifest and latent together on customer comments, and stickers of smiley faces to note sentiment. Coding was based on a Grounded Theory (Glaser and Strauss 1967) approach, with labels not firmly decided before being applied but rather discussed collectively as people began to interpret the raw text data. Talking aloud as they went, the workshop participants discovered themes and patterns across the customer journeys, and the codes began to reflect these patterns and become more aligned. The workshop ended with identifying and collating the key themes that emerged when going through the customer data and discussing significant pain points and turning points in the customer journeys. It was at this point that themes of customers losing confidence in their decisions, seeking clarity of information or wanting help from customer service, and which choices caused confusion for customers was shared. The result was that each product team member, CX manager and

web developer had a detailed understanding of one customer journey, and an understanding of how that one journey fit into the patterns and themes of other customer journeys. Using this digital synthesis process to draw out the pain points and trigger points for emotional responses evoked by the customers interaction with the booking system was a powerful way to elicit empathy with the customer. Coding collaboratively also produced usable, synthesised research results quickly and effectively on a digital platform accessible to all involved in the project. The Trello board with this customer data is still utilised by the product team as a reference to the customer experience.

## **Narrative Analysis Workshop**

Following directly from the Trello coding workshop, the same participants gathered for another workshop to explore the customer's relationship with the online booking system in greater depth. To do this, the UX Researcher chose to use Narrative Analysis to guide the workshop and apply some abstract thinking onto the customer journey with online booking.

Narrative Analysis combines epistemology and anthropology by relating a human experience of a certain phenomenon and overlaying this with how a knowledge structure, or storyline is built to understand the interplay between characters and events within that experience (Sinclair Bell 2002). The analysis format takes the shape of the story plot, roles of the characters, trigger points, chains of causation and the conclusion to provide structure and context to human experiences (Golsteijn & Wright 2013). Narrative Analysis' strength as an analysis tool is to draw out users' tacit needs, those unspoken or unarticulated desires that are not easily accessed through direct questions (Pucillo et al. 2014; Clandinin & Rosiek 2007). Storytelling offers participants in the narrative an opportunity to 'read through the lines'; to interpret emotional and psychological subplots and understand the position of different characters in relation to each other (Pucillo et al. 2014). Narrative Analysis engaged workshop participants in the underlying 'story' of the customers struggle with booking online.

For the context of this project, The UX researcher positioned the user of the booking system and the booking system itself as opposing protagonists in the narrative of a customer aiming to complete a booking on a trip. We started with discussing what the customer's starting position was before 'meeting' the automated booking system to establish how that relationship subsequently played out. Each workshop participant was asked to keep their customer journey in mind that they had coded for with Trello, but also keeping an aggregate 'portrait' of a customer trying to book an Intrepid Travel trip. Workshop participants concluded that before 'meeting' the booking system, a customer is confident of their choices, ready to commit, feeling in control of and responsible for their budget, decisions and travel plans and excited to finalise the next part of their travel by booking their Intrepid Travel trip. Establishing customer agency as the starting point based on data from the usability testing was critical in understanding how the user's positionality changed in the storyline of making their booking. So, what happened when the customer met the online booking system?

We used the following questions to guide an analysis of the customer's narrative of engagement with the online booking system:



- Where do customers situate themselves in the narrative of booking an Intrepid trip online? How does the narrative develop, is there a sense of an underlying ideal or aim the participant is trying to attain?
- Do customers maintain the agency they started with, or are they subject to certain influences or power out of their control?
- At what points in the booking journey do these power structures between the customer and the online booking system switch or change? what are these changes influenced by?
- What do customers identify as getting in the way of fulfilling their journey? What do we, having knowledge of the system or the business, see as getting in their way? What do the customers do when they come across blockers?
- Where are their high points and low points in this narrative – who or what is involved in creating these moments?

By using these questions to guide the analysis process, the workshop participants were able to identify the problematic dynamics of agency, control and responsibility that sat at the crux of the relationship between the customer and the online booking system. Narrative analysis applied to this project abstracted the customer from simply being the user of an automated system, to a person with agency, whose interactions with an online booking system affected them psychologically and emotionally.

Using this analysis methodology tangibly changed the stakeholder perspective on the booking system and its impact on customer experience. Working collaboratively also allowed people in the workshop to have their own moments of realisation, connection between concepts and real empathy for the customer that pushed beyond just the recognition of pain points.

## **Workshop Conclusions**

Uncovering the specific ways in which the automated booking system progressively unravelled a customer's confidence and control, made workshop participants realise the clear connection between digital design and agency. The establishment between user's lack of control, confidence and clarity while making a booking led the product team to decide to have these principles as foundations for the new booking system. Coming to those conclusions collaboratively, having been on the journey, meant that the product team fully understood why agency was a causal factor in customer interactions with a booking system. They were therefore fully invested in designing solutions that maintained clarity, confidence and control; ultimately an overarching and sustained sense of agency for the customer when making an online booking with Intrepid Travel.

## **IMPACT OF CUSTOMER AGENCY ON PROJECT OUTCOMES**


Results from this research and analysis had direct impact on new product development, UX design for the new booking system and transactional emails between booking and departure. Each sprint team member had been connected closely to at least one customer's

experience of the booking system through the Trello synthesis and Narrative Analysis workshops. This empathy with the customer experience affected the prioritisation of product development work, where room type and extras, having the most significant negative impact, was given most attention and focus. For this case study paper, I will focus on the UX design outcomes for the new booking system, as these most clearly demonstrate the impact of the research results. Product development for the new booking system and transactional emails relating to booking is still a current, ongoing project. Therefore, work on the email journeys has not come into focus for the project team yet.

Customer choices and the outcomes of those choices were found in research to be the most significant issue affecting customer agency when booking. Therefore, the product team chose to prioritise work which improved the customer experience of decision-making within an automated booking system.

## **Translating Clarity, Confidence and Control Into UX Design**

The UX designer and UX researcher worked closely together to synchronise the customer research into design principles that maintained customer agency throughout the booking process. Combining visual hierarchy, information boxes, iconography, UX copy and micro-copy were underpinned by the aim of providing customers clarity, confidence and control; together maintaining customer agency through the entire booking process. Designing for clarity included visually demonstrating where a customer is along the booking process, and which step they must complete next. Also providing clear information between the choice's customers are making combined with information and/or confirmation on the outcomes of those choices. Confidence could be translated into design by UX copy that ensures customers are making informed decisions during booking that are appropriate for their needs. Design that communicates what customers must do at each stage of the booking process in order to complete a booking for their selected trip also aimed to increase a sense of confidence for customers. Lastly, a focus on control translated to UX copy that communicates to customers the difference between their responsibility and Intrepid Travel's responsibility in taking actions related to their booking. The following figures demonstrate these design principles in UX wireframes for the 'Rooming Options' page [Fig.3] and the 'Optional Extras' page [Fig.4].


Call 1300 458 437

1 Your details
2 Tailor your trip
3 Payment

## Tailor your trip

### Test's room type

Test, would you like your own room?

☒ Yes please  
AUD \$1,808.00 (per person)  
You will have your own room

☐ No thanks  
AUD \$1,323.00 (per person)  
You will be sharing a room

### Tester's room type

Would Tester like his/her own room?

☒ Yes please  
AUD \$1,808.00 (per person)  
You will have your own room

☐ No thanks  
AUD \$1,323.00 (per person)  
You will be sharing a room

### Test's room type

Would Test like his/her own room?

☒ Yes please  
AUD \$1,808.00 (per person)  
You will have your own room

☐ No thanks  
AUD \$1,323.00 (per person)  
You will be sharing a room

### Select the extras you'd like us to arrange...

☒ Flights to the destination and back home

☒ Transportation from the airport to your starting hotel

☒ Transportation from your finishing hotel to the airport

☐ More information about compulsory travel insurance

☐ Accommodation before your trip

☒ Accommodation after your trip

Individual prices for your selected extras will be listed in your confirmation invoice. In the meantime, if you have any questions feel free to call us any time on 1300 458 437.

### Donate to The Intrepid Foundation

Would you like to donate 2% of your trip price?

The Intrepid Foundation is the not-for-profit entity of the Intrepid Group. We support local organisations who create sustainable livelihoods for communities all over the world. We double your contribution for twice the impact, give 100% of that money directly to projects and empower local people.

☒ Yes please  
A 2% donation will be added to your booking

☐ No thanks

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Continue

### Best of Morocco (XMSC)

Days: 15 [View map](#)

**Start**

Casablanca, Morocco  
Sun 03 Mar 2019

**Finish**

Marrakech, Morocco  
Sun 17 Mar 2019

**Passengers**

Ms Test Testing  
Mr Tester Testing  
Mrs Test Test

**Room type**

Test (Shared Room)	AUD \$1,470.60
	AUD \$-147.00
Tester (Own room)	AUD \$1,955.00
	AUD \$-147.00
Test (Shared Room)	AUD \$1,470.60
	AUD \$-147.00

**Flights** To be confirmed

**Airport pickup** To be confirmed

**Airport dropoff** To be confirmed

**Extra night after** To be confirmed

**Donate to The Intrepid Foundation** 2% of your booking

**Price was: AUD \$-4,895.00**


**Total trip price: AUD \$4,454.00**

Have a question or need some help with your booking?

1300 458 437

[Privacy](#) | [Booking conditions](#)

Figure 2. Before – ‘Tailor your trip’ page: Room Type, Extras and The Intrepid Foundation donation.


Call 1 800 970 7299


1 Your details
2 Rooming options
3 Extras
4 Payment


## Rooming options


Many Intrepid trips have different rooming options available on request. The trip cost includes a shared room with yourself, and one person of the same gender.


Options for [Pax]

Options for [Pax]


☐ **Happy to share (Default)**  
 This is the default rooming included in your trip.  
 There will be no additional charge.


☐ **I'd like my own room**  
 AUD \$1,234 per person


☒ **Twin Share room with another passenger in the booking**  
 I want to share with  
  
 AUD \$1,234 per person


☐ **Double bed with another passenger in the booking**  
 I want to share with  
  
 AUD \$1,234 per person

### Booking summary

**Trips**

Vietnam Express Southbound

**Days** 10

**Start** 26 Aug 2019  
Hanoi, VIETNAM

**Finish** 04 Sep 2019  
Ho Chi Minh City, VIETNAM

**Passengers** 1

**Per adult** AUD \$1,555.00

**Total** AUD \$1,555.00

[View map](#)

**Can't see what you're looking for?**

Not seeing the room configuration you're after? Feel free to give our team a call on [n=region specific number] to help you with your booking enquiry.

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Figure 3. Proposed UX Design for 'Rooming Options' in new booking system.

This is the UX Wireframe [Figure 3.] for a customer booking a trip with two passengers, selecting their room and bedding options simultaneously. Here the selection process is made clear with the combination of UX copy, visual representations of the bedding configurations and pricing for single supplements, without the 'travel jargon'. Customers can clearly identify the outcomes of each choice, understand that they will be choosing both a room and bed, and that the other passenger that is part of the booking is included in their selection.



Call 1 800 970 7299



## Optional Extras

Let us know if there's any extras you'd like information about - you can expect to hear from us within 48 hours with confirmation or details. Insurance is compulsory.

Options for [Pax]

Options for [Pax]

### Select your extras, [Pax name]



- ☐ **Information about compulsory insurance** ⓘ  
Insurance is compulsory on all Intrepid trips. We can help you get set up with the right insurance for you.



- ☐ **Quotes on flights** ⓘ  
Want Intrepid to organise flights for your trip? Too easy.



- ☐ **Pre-trip accommodation**  
Planning on landing in your trip destination a little early, and need somewhere to stay? No problems.
- ☐ **Post-trip accommodation**  
Wanting to keep wandering after your trip? We can help with accommodation.



- ☐ **Airport pick-up, Hotel drop-off**  
Need a hand getting from the Airport to the hotel with all your bits and pieces? No problem.
- ☐ **Hotel pick-up, Airport drop-off**  
Homeward bound! We can organise transport to the airport for you.

### Booking summary

#### Trips

##### Vietnam Express Southbound

Days	10
Start	26 Aug 2019 Hanoi, VIETNAM
Finish	04 Sep 2019 Ho Chi Minh City, VIETNAM
Passengers	1
Per adult	AUD \$1,555.00
Total	AUD \$1,555.00

[View map](#)

### Can't see what you're looking for?

Not seeing the room configuration you're after? Feel free to give our team a call on [n-region specific number] to help you with your booking enquiry.

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Figure 4. Proposed Design for 'Optional Extras' selection

The UX wireframe for Optional Extras selection [Fig.4] is a separate page to 'Rooming Options' to reduce the cognitive load of multiple choices for customers on each booking step. The UX copy details that selections made by customers will be responded to by Intrepid Travel within 48 hours. There is also more detailed information provided for each choice, and the copy is friendly and free from travel jargon. This provides customers clarity on their selections, where they are confident that selecting a 'quote on flights' will provide them with a quote on flight options from Intrepid Travel within 48 hours.

These UX wireframes make the principles of clarity, confidence and control derived from the research tangible, and contrast with the confusing presentation of decisions in the 'before' example.

## CONCLUSION

This case study highlighted the value of an ethnographic approach on understanding real customers engagement with an automated booking system, and how this affects them emotionally and psychologically. Central to human agency, is the ability of individuals to control their actions, where there is direct connection between one's actions and the outcomes (Young & Beckmann 2005). For a user interacting with an automated system, a sense of agency relies upon the user having control over their input and receiving a response from the system which acknowledges their intention (Anderson 2008). Intrepid Travel's automated booking system affected user's sense of agency by presenting them with choices and outcomes which were ambiguous; thus, removing control in users making their own decisions. The design and function of the booking system progressively caused customers to become confused about choices relating to their trip, feel a loss of confidence in their decisions and ultimately lose a sense of control over their actions. Ultimately, these factors contributed to users feeling a loss of agency, which resulted in customers abandoning the booking system altogether, or calling customer service to clarify information and restore their confidence and sense of control. UX design that assists customers in being able to independently make decisions to complete their booking provides a positive experience for customers.

Using real customers and digital ethnography through screen and face recordings enabled metrics to be captured beyond usability and functionality of a web product. Highlighting the complexity of this experience with booking a trip provided answers to the 'why' questions of customers exiting the booking process and having high incidence of contacting customer service with questions about room type and extras. Using analysis techniques that engaged the web development team and key stakeholders from the customer experience department had a positive impact in creating understanding and empathy for customers booking Intrepid Travel trips online. Using Narrative Analysis especially, demonstrated to the workshop participants how abstract social concepts such as agency can be derived from customer data, and become tangible, usable insights to drive impactful decisions. Understanding the customer experience of booking a trip holistically, assisted the product development team in prioritising design solutions that would improve customer experience dramatically. Maintaining customer agency as a foundational aspect of booking a trip through design that promotes confidence, control and clarity proved an essential component in the success of this project.

**Alice Watson** is an anthropologist working in UX Research, and passionate about bringing ethnographic theory and praxis together with technology to make impactful UX design. Alice is passionate about storytelling, sense-making and exploring connections between human needs and design. You can contact her at [alice.watson@intrepidtravel.com](mailto:alice.watson@intrepidtravel.com)

## NOTES

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## More than a Robot

### Designing for the Unique Advantages of Sending Humans to Mars

PAIGE PRITCHARD, *Carnegie Mellon University (alumnus)*

NICK MURPHY, *Carnegie Mellon University (alumnus)*

SHILPA SARODE, *Carnegie Mellon University (alumnus)*

LOUI VONGPRACHANG, *Carnegie Mellon University (alumnus)*

*NASA plans to send humans to Mars as early as the 2030s. Such a complex and expensive undertaking is justified by the fact that only humans have the unique set of abilities inherent to scientific exploration. A team of four graduate students from Carnegie Mellon's Master of Human-Computer Interaction program took a user-centered design approach to identify breakdowns in current processes used in the practice and execution of extraplanetary exploration. Through a combination of secondary research, co-design, body storming, and ethnographic research including interviews and field studies, they found that current operational procedures constrain the human abilities of physical agility, adaptability, and perceptiveness. This effectively ignored the advantage of human agency over robotics. They used this insight to prototype a solution designed to streamline mission operations. This prototype was then tested against the goal of allowing team members to focus on leveraging their unique human abilities to deliver higher scientific return.*

## INTRODUCTION

### Our Mission: Help Humans Explore Mars

In January 2016 the NASA Ames HCI group delivered a design prompt to Team Scoria, a capstone project team of four graduate students from Carnegie Mellon's Master of Human-Computer Interaction program. The Ames stakeholders were interested in developing a tool to help guide humans as they perform geologic exploration on the Martian surface in future human-staffed missions to Mars. They pointed the capstone team to the current "cue card" system as inspiration — this system is comprised of wrist-based cue-cards that give astronauts step-by-step directions on how to complete tasks in space. The paper cue cards were used during the first trip to the moon, and they are still used today on the International Space Station. The Ames team was interested in how digitizing these cards might increase the amount of information they contained, thus increasing exploratory abilities (Carr, Schwartz, and Rosenberg, 2002).

### Understanding The Case For Sending Humans To Mars

Although these cue cards are now used during space walks on the International Space Station, the last time they were used for extraplanetary exploration was in 1972 when Apollo 17, the last Apollo mission, landed on the moon. Since then various projects within NASA have been working toward the opportunity to continue this planetary science work either on the moon or further on to Mars. Projects of this type that presented the most relevance to the Scoria team's work fell into two categories:



## *Rovers*

NASA has been sending spacecraft to Mars since 1965 when it sent the Mariner 4 spacecraft to fly by the planet for the first close-up images of the Martian surface. Since then it has sent multiple rovers to perform a variety of tasks including: biology experiments searching for signs of life; mapping the entire Martian surface, atmosphere, and interior; conducting initial field geology; analyzing soil and rock samples for organic compounds. The current work of rovers on the Martian surface will help inform future human-staffed missions to the planet. Even now they are transmitting photographs and spectral images so that scientists on Earth can scout out the most promising locations for potential human exploration.

However, the precedence for sending humans to Mars is much different than the reasoning for the Apollo program. The competitive nature of the space race provided ample motivation for multiple landing missions. A mission to Mars, however, will be much more focused on scientific data collection from the start. As a result, NASA is investing for high-quality scientific return from studying the geology of the planet. There is also the added skepticism over sending humans to Mars when there is already so much to be learned from the rovers being sent there.

Team Scoria learned that while many scientific processes are better off being programmed into a standard and repeatable set of instructions, field geology is an exploratory science in which human perception and insight are great assets. In geology, priorities need to change on the fly and human instinct can inform those changes to obtain impactful results. Field geologists call this type of dynamic reprioritization “flexecution”. [Hodges and Schmitt, 2011] It is the human ability to quickly switch between execution and discovery, between set procedures and exploratory instinct. This is a key element in arguing for a human-staffed mission to Mars. In light of this, and as a human-centered design team, the Scoria members identified the preservation of these abilities as a guiding motivation during the design process.

## *Analog Missions*

Sending humans into space is a monumental task, whether it be to the ISS, the moon, an asteroid, or Mars. To test protocol NASA divides the preparation into smaller problem spaces, explored through several analog missions on Earth. These analog missions practice for missions in space while also collecting valid scientific data here on Earth. (Lim, 2010). Examples include:

- NEEMO: based off the Florida Keys, this mission deploys aquanauts to an underwater habitat, utilizing buoyancy to simulate the gravitational reduction that astronauts face.
- D-RATS: This Arizona-based analog focused on testing space suit ergonomics, field equipment, communication protocols and the use of a vehicle in a desert habitat.
- HERA: This three-chamber habitat studies the effects of isolation and confinement on the mission members’ physical and mental health.

- BASALT: This team of geologists and engineers traverses Idaho and Hawaii lava fields to study the geology of basalt, a rock that is also found in abundance on Mars. They also simulate the future Martian team structure and communication protocols between team members.

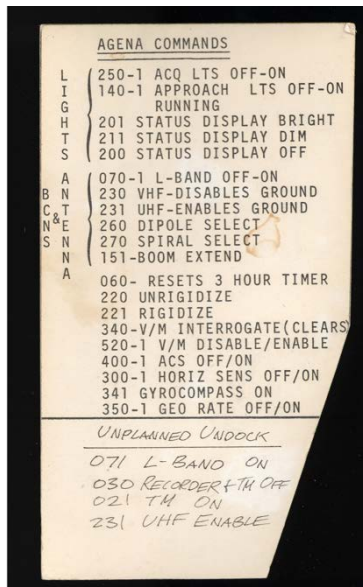


Figure 1. Checklist card carried by Michael Collins during the Gemini 10 mission, July 18-21, 1966. National Air and Space Museum, Smithsonian Institution.

## Defining the Users

In traditional human-centered design it is important to research and test products with users in their environment. This was obviously not possible for the Scoria team since there are currently no astronauts on Mars to observe or test with. As a result of this, the Ames group and Scoria team decided together that the best opportunity to design for Mars while also testing with users would be to partner with the BASALT analog mission team. The goal would be to create a tool for BASALT team members to use during analog mission execution. These missions already provided a rich environment in which to test new ideas around what technology, operations protocol, and team structure should be used in space exploration. By choosing to partner with the BASALT team the Ames and Scoria members were able to move away from speculative to applied design.

## APPLYING ETHNOGRAPHIC RESEARCH PRACTICES TO HARD TO ACCESS USER BASES

### Acknowledging Research Challenges

Overcoming the challenge of identifying the users only presented more challenges for the Scoria team. The team convened with its CMU and Ames advisors to plan out a research and design roadmap. In doing so the group identified the following challenges that would need to be addressed if the team wanted to adhere to user-centered design principles.

1. **Gaining access to users.** The BASALT team was dispersed across the U.S. and would only come together twice for exercises during the capstone project timespan. These exercises provided the best opportunity for ethnographic field observation. However, the Scoria team would only have a few days each time to shadow the users. They were also limited on how close they could shadow the users, so as not to obstruct the BASALT team's own data collection process during the exercise
2. **Misaligned timelines.** The BASALT mission team was still in the early planning stages of its mission when the Scoria team kicked off research, which resulted in a misalignment of timelines. The Scoria team would not be able to conduct the foundational research of observing the team performing a mission in the field until months into the research process. The Scoria team would have to move forward with other methods of foundational research while maintaining flexibility so as to fold in research from the field work at a later point.

### Preliminary Research on the Protocol and Tools of Human-Staffed Space Missions

To better understand the problem space the Scoria team performed an initial literature review and set of interviews with geologists and NASA scientists. The purpose of this early-stage research was to develop a comfortable familiarity with the domain. This broad approach provided a informational foundation upon which the team then built a more finely-scoped research roadmap.

#### *The History And Utility Of Exploration Aids*

The Scoria team first reviewed existing literature covering past NASA research on the various designs and prototypes of procedural aids (including cuff checklists, cue cards, and digital devices) (Hersch, 2009). This review helped the team develop a general understanding of why astronauts use cue cards for exploration and the history of their use. From there, they strategized a research plan to solve the remaining unanswered questions around how the design of cue cards impact mission operations. To answer these questions the team conducted a series of expert interviews with NASA scientists and engineers, all of whom had either designed or used some form of cue card exploration aid.

They talked to Trevor Graff, Project Manager of Advanced Explorations Group at Johnson Space Center. In helping plan NEEMO analog missions, Graff had found that the historic text-heavy design of NASA cue cards supported procedural execution, such as following safety protocol and ensuring correct documentation. However, they did a poor job of supporting exploration activities — he observed that crew members spent too much time focusing on the text of the cards and not enough time observing the environment around. He redesigned the cards to include visual and graphical information. This approach was adopted by other analog missions to help crew members with introductory scientific training complete complex scientific exploration (Graff, 2016).

They then talked to David Coan of Johnson Space Center Extravehicular Activity (EVA) Office and NEEMO 20 Aquanaut. Coan worked with ISS astronauts to design spacewalk support materials. He had used Graff's redesigned cards himself as an aquanaut during the NEEMO 20 mission. He said the image-heavy design helped guide him in performing marine science, and that the biggest breakdowns were related to the human factors of dealing with laminated cards becoming slippery when used underwater.

Finally they talked to Darlene Lim, BASALT Principal Investigator and FINESSE analog mission Deputy Principal Investigator. Lim emphasized mission constraints, specifically communication delays. These delays can have a significant effect on the interactions between team members. To work amongst such constraints, Lim emphasized that mission teams must be able to balance competing priorities. To achieve this goal, she focused much of her time as BASALT PI working to ensure constant communication between all members of the analog mission.

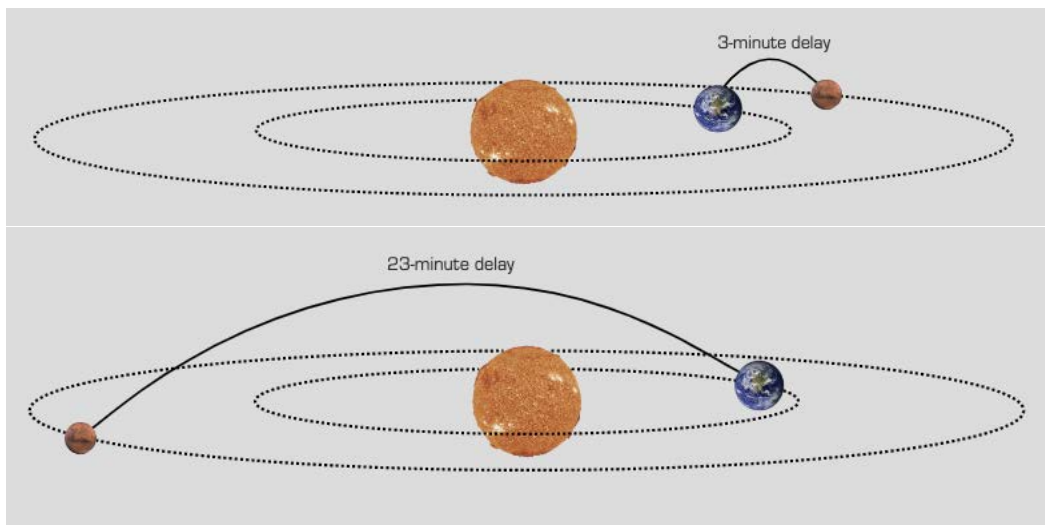


Figure 2. At any given moment the delay for any communications to travel one-way between Mars and Earth is between a 3- and 23-minute delay. The BASALT team recreates this in analog missions by instituting a false delay of 15 minutes for communications between the Mars surface and Earth Mission Control teams. Illustration by Scoria team members.

### *The Operational Protocol of a Mars Geologic Exploration Mission*

Each NASA analog mission follows a specific set of operational protocols to meet the dual goals of replicating the constraints of an actual space mission and performing valid scientific observations. Protocol can differ depending on the mission focus. Via the literature review and interview with Lim, the Scoria team began to understand the complex procedural structure their users would be operating within. Anything the Scoria team designed would have to fit seamlessly within these pre-established and well-researched protocols.

The BASALT mission follows the same team structure and protocol that NASA intends to use for Mars explorations. The team structure is comprised of three main roles (outlined in Figure 3):

- **Extravehicular (EV):** The EV performs the “boots on the ground” role on Mars. They suit up and perform extravehicular traverses on the Martian surface to collect geological samples. They communicate with the Intravehicular crew member and refer to wrist-based cue cards to ensure they are meeting scientific goals.
- **Intravehicular (IV):** The IV has their “eyes on the ground” for the EV while on Mars. They stay inside the habitat on the Martian surface and communicate what the EV is seeing to the Science Backroom Team (SBT) and send feedback from the SBT to the EV on what samples to collect.
- **Science Backroom Team (SBT):** The SBT is a team of scientist experts on Earth who analyze data collected by the EV on Mars and make recommendations to the IV on what sites they should tell the EV to pursue and where to samples from.

The Scoria team also used information from the literature review and interviews to map out the timeline of a geological traverse, the part of the mission where the EV ventures outside of the habitat to collect samples. This helped the team identify the various goals of each user at various stages of their mission journey.

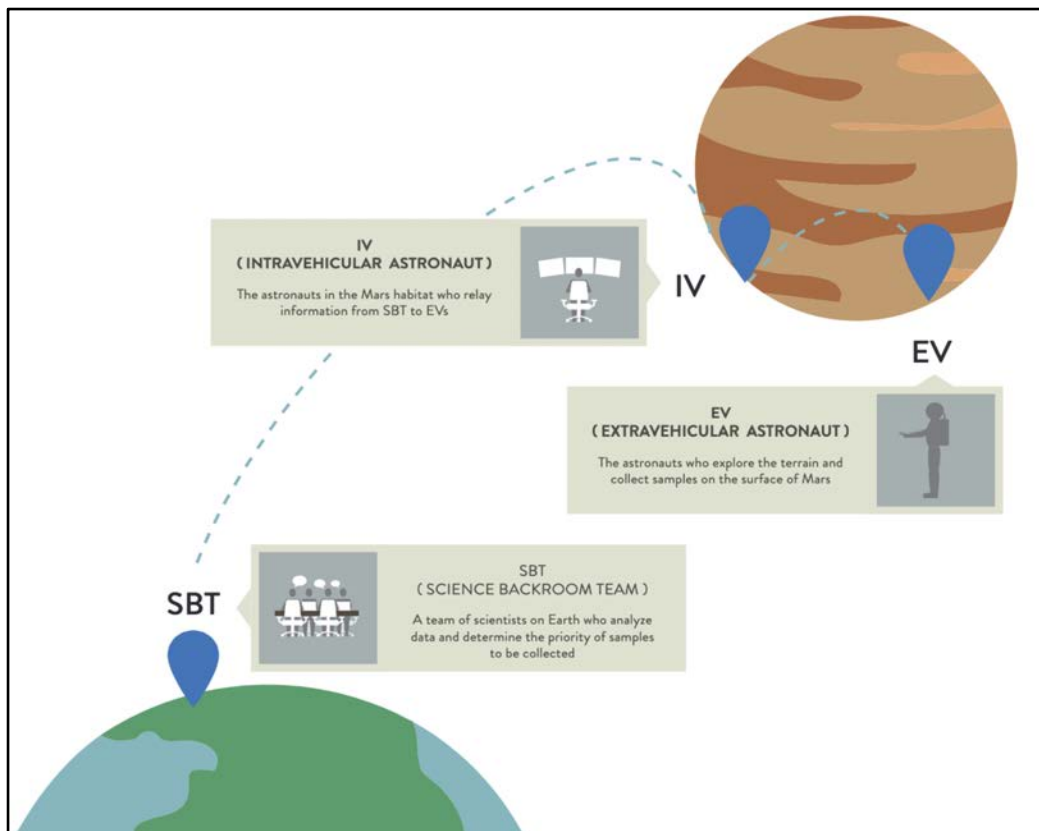


Figure 3. The operational team setup of a Mars mission, to be recreated by the BASALT analog mission team. Illustration by Scoria team members.

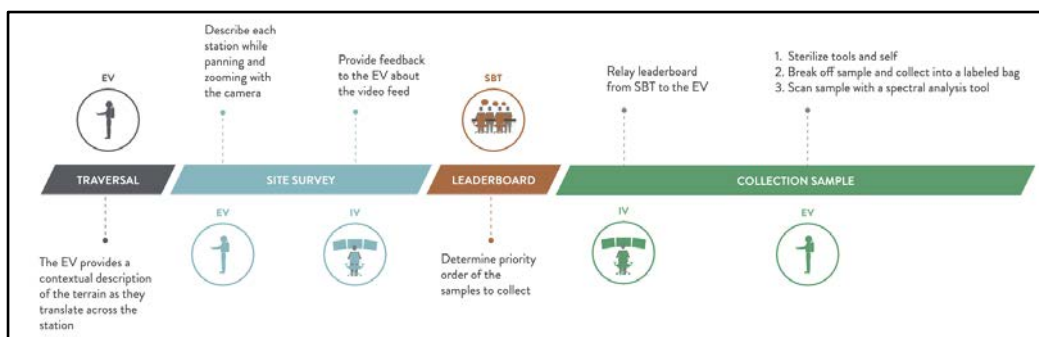


Figure 4. The timeline of a geologic traverse. Illustration by Scoria team members.

## Workshopping and Bodystorming User Needs and Pain Points

The preliminary research established a firm foundation for the Scoria team to work from. By taking the time to map out the complexity of the problem space, the team was able to

pinpoint next steps for the research. This involved understanding the users' breakdowns and pain points. To achieve this, the Scoria team held a workshop with NASA analog mission geologist and performed a bodystorming exercise of the BASALT operations protocol.

### *Workshopping User Needs*

The Scoria team visited Goddard Space Flight Center to meet with four planetary geologists who doubled as participants in NASA's analog missions for Mars. Once again, the team had limited access to these users and were allotted exactly one hour with them. So, rather than a traditional face-to-face interview, Scoria members decided to run the meeting workshop-style with two co-creation exercises. This enabled them to collect a large amount of information from multiple people in a small amount of time.

**Love/Hate Exercise:** In this exercise, the geologists were asked to write out what they loved and hated most about doing geological field work.

- Themes of what the geologists loved included: the challenge of the science, the idea of exploration, and working with fun and intelligent teammates.
- Themes of what the geologists hated included: carrying clunky scientific instruments, novice field workers making poor safety decisions, teammates not being flexible, and getting interrupted in the middle of a task.

**Fairy Godmother/ "Supersuit" Exercise:** In this exercise the geologists were asked to imagine either a fairy godmother who could grant them any wish or to imagine their ideal field geology "supersuit" and sketch these on a piece of paper. Some examples of desires users expressed through these sketches included:

- The ability to reference sample data that has already been collected
- A glanceable status check of their teammates' safety
- A way to offload the physical weight of instruments, samples, and tools

These exercises helped bring the most salient problems to the forefront quickly, making great use of all of the attendees' time and leaving extra time for rich discussion.

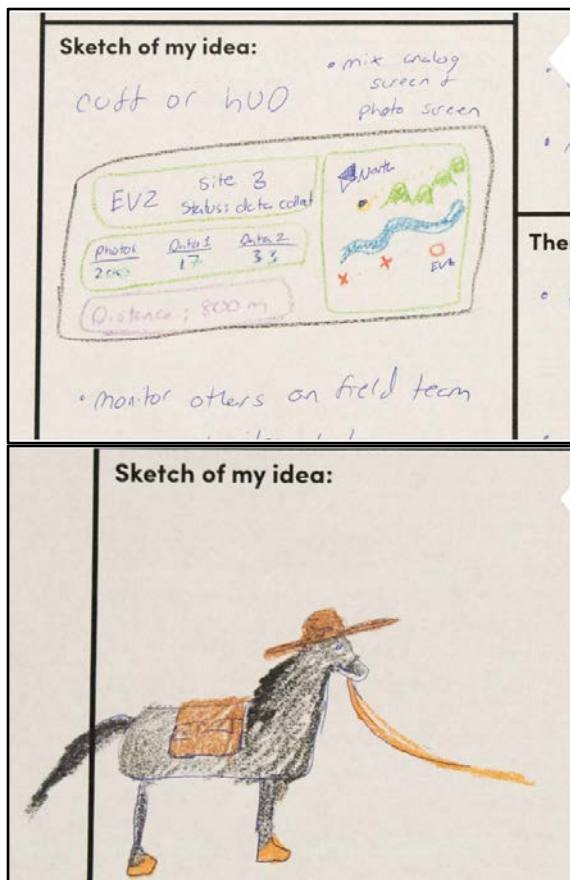


Figure 5 (left). One geologist drew an augmented reality heads-up display to monitor team safety. Figure 6 (right). Another took a lower-tech solution and asked for a donkey to carry their equipment as their idea of a “fairy godmother”. Photos taken by Scoria team member.

### *Bodystorming A Mars Mission In Pittsburgh’s Frick Park*

With three months of user research finished and a month left until they would get to observe the BASALT users in person, the Scoria team decided to put the knowledge they had collected into action and run a mock analog mission in Pittsburgh’s nearby Frick Park. Walking through the operational protocol themselves would help the team develop a closer understanding of it, thus better preparing them to strategically approach the upcoming in-person observation of the BASALT team.

This exercise also presented an opportunity for the Scoria team members to test out some hypotheses they had developed around user pain points. These hypotheses included concerns over team communications, human factors issues of balancing cue cards with other scientific equipment, and the EV being too distracted by operational protocol to engage in exploratory behavior.





Figure 7. The Scoria Team recruited classmates to run the bodystorming exercise. These participants created a grid system in their cue card maps to help streamline communications. Photo taken by Scoria team member.

The Scoria team designed the exercise to mimic as many of the BASALT team procedures as possible. Instead of Mars or a lava field on Earth, they studied a local park. They replaced the BASALT science objective of exploring microbial geology with the objective of characterizing the park's tree life. The team then recreated the mission workflow by assigning team members to the three main roles in a traverse (EV, IV, and SBT) and by simulating a time delay of five minutes between the IV and the SBT. Using Google Earth for remote imaging data, they planned a path to have the EV explore through the park. They then identified samples of interest (such as acorns, pine cones, and types of trees) and equipped the EV with Tupperware to collect the samples.

During the exercise the EV was required to wear a cumbersome jacket and gloves to simulate the physical constraints of an astronaut suit and BASALT team equipment. All three team members were able to communicate with each other via phone connection, the EV wearing a headset on call to the IV. Meanwhile the IV was also on a separate call with the SBT with a 5-minute time delay for messages sent either way. Both the IV and the SBT had access to a computer and had Google Earth pulled up during the traverse to help track and direct the EV toward areas of interest in the park. The team also instituted a 40-minute time limit from the time the EV left the car to when they returned, recreating the constraint of having limited oxygen supply.

The Scoria team ran the exercise twice, once taking on the crew member roles themselves and once where they recruited classmates to be the crew members so they could observe. Running the exercise as crew members gave the Scoria team insight into the psyche of all three roles during a traverse. They particularly felt pressure related to the time constraints and communication delay.

Running the exercise as observers gave the Scoria team an opportunity to observe how the participants interacted with each other. They were specifically interested in how the participants notated their cue card materials with a grid pattern to better communicate location with each other.

## **Contextual Inquiry with the BASALT Team**

At the end of May 2016, the Scoria team traveled to the Ames Research Center in Mountain View, California to observe NASA's BASALT team practice a Mars traverse. BASALT used an outdoor space on the Ames campus called the "Mars yard" to simulate the hills, craters and rocks typically found on Martian terrain.

Since this was one of the few times the Scoria team would be able to observe a traverse in person, they strategized how to split up the team to observe areas of interest. This strategy was informed by prior research and the bodystorming exercise. The Scoria team identified the IV as a user of particular interest due to its role as a communicator to both the EV and SBT, and the pressure to communicate within a time delay. The team was also interested in how the EV balanced referencing cue card material with making exploratory observations in the form of vocal descriptions and photographs. Finally, the team was interested in how the SBT took in all of this information to make recommendations for where the EV should take a physical rock sample.

The Scoria team spent three days observing the BASALT team with emphasis on the above areas of interest. They took these observations back to Pittsburgh and started to combine them with prior research for a holistic analysis of the user journey of a BASALT mission.

The Scoria team used the affinity diagramming method to synthesize data across all of their research (Beyer and Holtzblatt, 1999). This allowed the team to deconstruct the data into single units of information and reconstruct the units into meaningful groups, through which themes emerged.

## **RESEARCH FINDINGS**

### **High-Level Finding: The Human Advantage Was Not Being Leveraged**

NASA based its reasoning for sending humans to Mars on the differentiating qualities of physical agility, situational adaptability, and perceptual acuity. However, the Scoria team observed that these abilities were not being emphasized in the existing operations protocol for analog missions. The Scoria team proposed that without leveraging these human advantages, a human-staffed mission to Mars would be equivalent to sending the world's most expensive extraplanetary robot to the planet.

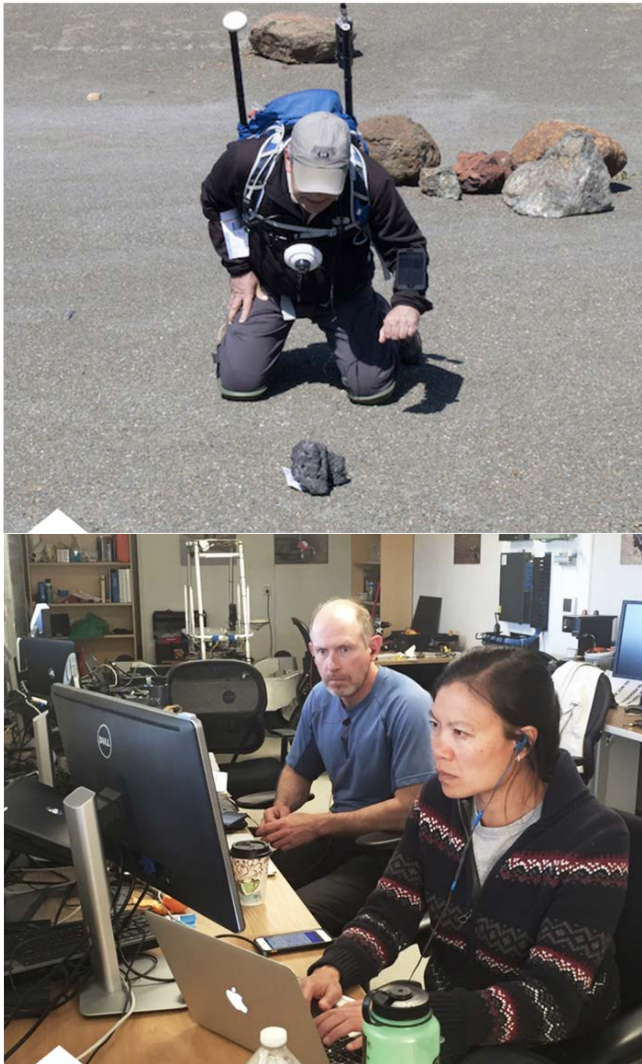


Figure 8 (left). The EV observes a potential rock sample, getting on his knees to keep the rock in the frame of view of his chest camera for the IV and SBT teams. He is also wearing a heavy backpack full of networking equipment that both allows him to communicate with the IV and serves as a recreation of the physical constraints astronauts will endure on Mars. Figure 9 (right). In the IV station, two BASALT teammates keep an eye on the EV's progress and communicate it to the SBT. Photos taken by Scoria team member.



Figure 10. The Science Backroom Team (SBT) awaits more information before they can determine the priority of samples to collect. Photo taken by Scoria team member.

## Vocal Communications Needed to Be Streamlined

During a traverse, the Scoria team observed the EV conveying a thorough description of the landscape and target samples to the SBT so they could determine what sites to prioritize for sample collection. These descriptions were rich with perceptual and experiential subtleties that only a human could provide. However, observations of the BASALT team during contextual inquiry revealed that this critical information was being lost amongst operational communications.

Voice was the primary communication line being used between the EV and the IV. It was used to check if cameras were working, confirm whether the EV had the go-ahead to move to another site, and to convey how many and what type of samples had been collected. In the midst of all this, it was also used to convey the detailed scientific descriptions the SBT based mission priorities on. Amongst all the logistical communication, there was a risk of these significant descriptions going unnoticed.

Not only was cluttered voice communication a risk for losing perceptual data, it was a hindrance to the EV's ability to focus on the task at hand. This was supported by earlier interviews with NASA scientists who expressed feeling cognitively overwhelmed with having to balance following operation protocol from the cue card with meeting science objectives. This also supported the high-level finding that without optimizing for the EV's perceptual contributions to the mission, the operation would not be so different from sending another rover to Mars.

### *Opportunities:*

For this research finding the Scoria team proposed the following opportunities:

- Operational updates could be communicated through other modalities, such as ambient displays informed by sensors.

- The word “standby” was used by BASALT team members when interrupted at inopportune moments. Non-vocal communication methods could be used to indicate availability instead.
- Filtering the EV voice communications could ensure only desired information was relayed to the science team. An EV might be more comfortable when verbalizing everything, but all of that information does not necessarily need to reach the science backroom.

### **The EV’s human experiential and perceptual data were not being captured in a permanent way**

As demonstrated in the previous insight, experiential and perceptual descriptions provided the most uniquely human data. The Scoria team had observed and interviewed multiple experts putting in considerable effort to make cue cards to help prompt the EV for these descriptions. However, the Scoria team observed that these descriptions were often haphazardly and hurriedly transcribed by the BASALT science backroom and ultimately not referred to at all during the traverse.

The Scoria team found that human observations provided two distinct types of data. Perceptual data came from the EV’s direct descriptions of their surroundings. This was mainly informed by visuals, but other senses helped inform this as well. Meanwhile, experiential data came from the EV’s emotion and tone during their descriptions. This data, if transmitted effectively, helped the SBT empathize with the EV and better understand the importance and magnitude of observations.

The hurried attempts at voice transcription in the science backroom were low in quality and not accessible in a way that made the information salient to team members. As a result, during critical decision points, such as determining the leaderboard of what sites to sample during a traverse, the backroom ended up defaulting to image data. This essentially defeated the purpose of human exploration; image data is something that Mars robots are already capable of providing to scientists. However, capturing human perceptual and experiential data is very difficult. It is not directly quantifiable, it varies from person to person, and it requires a highly effective shared vocabulary.

#### *Opportunities:*

For this research finding the Scoria team proposed the following opportunities:

- Finding and utilizing methods of capturing human perceptual data would better inform the science backroom. The first step should be building and mastering a strong shared vocabulary that goes beyond technical detail and description.
- The EV job and protocol could involve much more than pictures and scripted descriptions. It would make a difference to capture that “wow” factor that humans feel when seeing something in person.

## **Crew members assumed knowledge and understanding, resulting in varying mental models**

The inherent setup of analog practice missions involves a team of professionals with a very diverse set of expertise. Transference of this knowledge amongst teammates is critical to a successful mission. The Scoria team observed some knowledge sharing at the BASALT practice mission, but there were many instances in which team members experienced misunderstandings of basic, foundational information.

As the Scoria team found early on from interviews, diverse teams of experts develop problems of assumed knowledge. (CITATION) With a high level of respect for one another's intelligence, few people think to stop and explain the rationale behind certain decisions, while others do not think to stop and question them.

The Scoria team observed this phenomenon during the BASALT practice mission. For example, crew members had several discussions aimed at clarifying whether a geological exploration site was five meters in diameter or five meters in radius. The team also observed considerable confusion surrounding the required amount of rock sample to be collected, due to subjective and culturally dependent metrics such as "baseball-sized" and "softball-sized".

While these discrepancies in understanding were seemingly small, they could have potential consequences. If one of these misunderstandings occurred during a time-sensitive traverse, an EV could easily collect an insufficient amount of sample, rendering it completely useless for proper scientific analysis. Moreover, the human ability to "flexecute" during a traverse could really only occur with a deep understanding of the scientific goals. Without this understanding, the EV would struggle to adapt to the new environment.

### *Opportunities:*

For this research finding the Scoria team proposed the following opportunities:

- Having common visuals (diagrams, charts, etc.) during an EVA could make sure everyone establishes a common frame of reference for complex tasks.
- Co-creation of processes and decision points fosters internalization of the rationale behind those decisions. Having the EV involved throughout mission planning could help their ability to "flexecute".

## **Mission Aids Were Beneficial to the EV In "Execution Mode" but a Hindrance in "Discovery Mode"**

Mission aids included items to guide the EV in a formulaic way, such as cue cards, checklists, and GPS trackers. The Scoria team observed that they were appropriate tools for an EV to use in "execution mode", when the goal was to complete a task efficiently, much like a robot. However, the Scoria team observed that team members in the EV role felt the need to follow mission aids to perfection. This anxiety prevented the EV from engaging in "discovery mode", when the goal was to observe their surroundings for areas of interest.

The Scoria team learned that when an execution-oriented aid was put in front of someone, the person tended to follow it with precision, even when dealing with a discovery-

oriented activity. During one of the BASALT traverses, the EV felt the need to follow a guided walking path with great accuracy even though it was merely a suggestion. He might have missed an interesting rock on the side as a result of putting his focus to staying on the path.

In addition, the majority of all mission aids designed for the analog missions were designed for “execution mode” only. For example, the BASALT team built a guideline on how to approach unplanned sites of interest. However, even this discovery-oriented information was presented as an execution-style cue card. The Scoria team conceded that “discovery mode” aids might be more difficult to design due to their less prescriptive nature. But since “flexecution” is such an important human attribute, the absence of these aids presented a rich opportunity for future designs.

### *Opportunities:*

For this research finding the Scoria team proposed the following opportunities:

- The time for “execution mode” and the time for “discovery mode” should be clearly distinguished. Designing mission aids to clearly separate the two modes could help greatly. Current protocol tends to default to designing for “execution mode” only.
- There must be a great trust of the EV’s decisions. The EV needs to know that the team is confidently behind them when it is time to explore.

## **PROTOTYPE DESIGN AND TESTING**

### **Ideation through Rapid Iteration**

After presenting their research to the NASA HCI group and the BASALT team, the Scoria team orchestrated a visioning session with our users. They guided the group through an ideation exercise in which small teams generated ideas for design solutions via sticky note and paper prototypes. By the end of the exercise, the Scoria team and users had collectively generated just over 100 ideas. The Scoria team then grouped these ideas into eight high-level themes. They created a more detailed paper prototype for each theme that they then concept tested with their BASALT users.

The team decided to focus on improving the capture of the scientific observations coming from the EV. This use case was generated in direct response to the the second opportunity space that emerged in research regarding the experiential and perceptual, i.e. uniquely human, data being lost. A design to capture geologic observations in a clear and concise format would allow the science backroom team to easily reference the information while determining the leaderboard of sample priorities. Furthermore, storing the observations in a standardized, searchable database would allow for easy data aggregation across multiple sites during future analysis.

Once the Scoria team had their design space scoped down to capturing the EV’s scientific observations, they moved forward with developing a single design to address that specific scenario. They named this design “Fieldbook” in reference to the yellow notebooks geologists take into the field with them to write down notes and observations.



The team's initial design solution consisted of a tablet-based interface for the EV to carry into the field, and a desktop interface for the IV inside the habitat. The EV was able to take photos with the tablet and touch a specific point on the photo, when this happened the same point appeared in real-time on the IV interface. This interaction allowed the EV to clearly indicate each specific point of interest to which their subsequent observations pertained.

Each time the EV indicated a point of interest on the photo, the IV was provided with a form to capture the vocal descriptions that followed. Since the EV typically provided similar sets of information for each point of interest (color, surface condition, texture), the form was designed around these characteristics to allow the IV to quickly input commonly collected data. Standardizing the data input in this fashion would allow the IV to send an organized and concise data packet to the science team for real-time decision making.

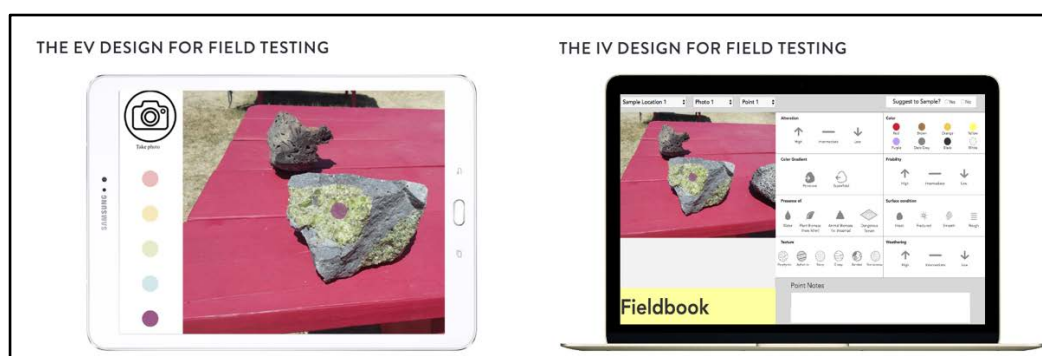


Figure 11. The initial EV and IV designs for Fieldbook. Mocks by scoria team members.

## User Testing Results in Design Pivot

The Scoria team moved forward with building an interactive prototype of their initial design to test with members of the BASALT team in the field. In July the Scoria research team met the BASALT team at the Craters of the Moon National Monument in Arco, Idaho. The BASALT team chose Craters of the Moon as a mission deployment site because of its similarity to the terrain on Mars. As the most recent eruption site in the continental U.S., with volcanic activity occurring as recent as 2,000 years ago, this lava terrain was the closest that the BASALT team could get to practicing field geology in an actual Martian environment.

During this testing the research team uncovered multiple insights for how to improve the design. The greatest insight was the desire for two-way annotation between the EV and IV in the interface. The Scoria team had intended the ability to annotate the photo with a dot to be an EV-only feature. However, the one-way constraint had not yet been added into the code at the time of the Idaho trip. During testing, the researcher noticed that IV users started using the tool to draw the EV's attention to elements that the EV had not noticed elsewhere on the photo. This accidental two-way pointing interaction resulted in rich discussion between the IV and EV and prompted the EV to explore the site further. This observation directly mapped to the team's goal to design for EV exploration over pure



execution. It was concrete evidence that fostering a focused, exploration-oriented conversation between the EV and the IV can result in new discoveries.

After discovering its value in the field, the Scoria team pivoted to fully supported the two-way pointing interaction for both the EV and the IV. They also implemented a drawing tool for both EV/IV UIs in response to the feedback BASALT users gave about wanting to be able to circle areas and draw arrows. Although these changes occurred late in the team's design cycle, they had maintained enough flexibility to incorporate the feedback knowing that the opportunity to test in the field would provide valuable data despite its inconvenient timing.

## Final Design: Fieldbook

After implementing changes in response to the BASALT user feedback, the Scoria team created a final prototype for the Fieldbook tool. Its core element was Fieldbook Canvas, a working two-part web application designed to capture geological observations during a traverse. This two-way image annotation tool was designed to bring the EV and IV into a shared mental space, equipping them to explore the Martian terrain together by drawing each other's attention to areas of interest. The EV was equipped with a belt and attachable tablet with which to take photos and annotate them on the Fieldbook Canvas app. The IV was able to pull the app up on their workstation inside the habitat.

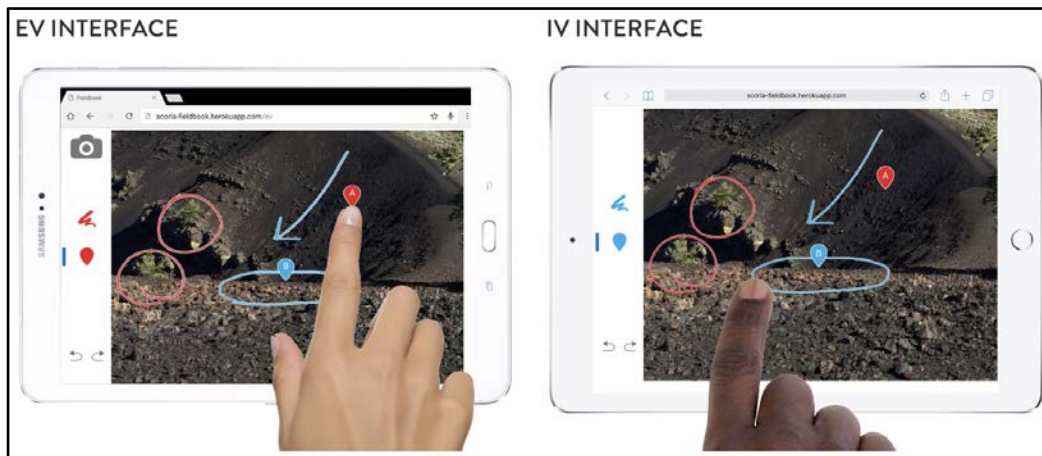


Figure 12. Final designs for the Fieldbook Canvas EV and IV interfaces. Both are able to drop pinpoints on areas of interest and use the draw function to circle areas and draw arrows. Design by Scoria team members.

The team also designed a concept and wireframe mocks for a second application they called Fieldbook Gallery. The Gallery tool was designed for the SBT to quickly parse the incoming images, annotations, and recordings from the EV and IV in order to make quick, informed decisions about sample priorities. It included incremental audio navigation controls to skip behind or ahead in the audio, the ability to add markers in an audio file to return to, and speech-to-text transcription of the audio files. It would also connect snippets of audio to a specific photo.

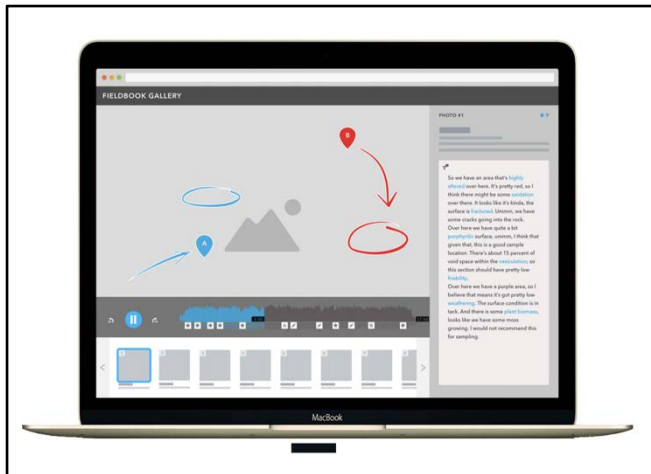


Figure 13. Final mock exploration for the Fieldbook Gallery tool for the Science Backroom Team (SBT). The tool would provide a view of each photo alongside the transcribed text that was recorded by the EV and IV while they were describing it as well as the ability to

Together, Fieldbook Canvas and Gallery met the user needs exhibited in the overall research insights in multiple ways. Primarily, the real-time annotation of Fieldbook Canvas allowed the EV and IV to collaborate closely with each other during the exploration process. The audio/visual data capture elements of Fieldbook Gallery prevented the need for the IV to take such rigorous notes for the SBT and instead freed them up to engage more with the EV on exploration tasks.

## CONCLUSION

### Design Opportunities for Increasing Human Explorers' Autonomy in a Mars Mission

However, the culmination of the Scoria team's research showed that current simulations of Mars geology work were not leveraging the advantage of human agency. Communication lines were chaotic, perceptual data were not captured, miscommunication resulted in inefficiencies, and all tools were made for procedural execution rather than in true support of the exploration-oriented mission.

The Scoria team took a user-centered design approach to prototype a product that addressed these breakdowns. This resulted in a two-part web application that fostered an exploration-oriented conversation between the crew on Mars and delivered a digestible data package to the science team on Earth to support quick and efficient realignment of priorities in real-time. The product could be implemented to streamline the operations of an exploration-based mission to make room for the inherent advantage of a human crew, ultimately resulting in increased scientific return and increased autonomy for the crew members.

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## PechaKucha and Papers Session

# Designing for Agency

Curators: April Jeffries (Ipsos) & Dan Lockton (Carnegie Mellon University)

The whole conference is about agency in various forms, but in the Designing for Agency session we are explicitly looking at how *design* and agency intersect, for designers and researchers themselves and in the ways in which communities can act to change their own context. Is design about outcomes, asserting the designer's agency, or about creating platforms and infrastructures for others to use and adapt and reconfigure to enable the expression of theirs?

The Pecha Kuchas primarily focus on questions of agency within. These creative expressions explore the importance of the individual researcher and the relevance of the personal lens to bring new levels of richness and ultimately impact to our broader more universal existence. We dissect how traumatic life changes can affect both the ability for agency and the choices made to exert it. And lastly, we explore how the tools of the artist can point us towards a universal language beyond words and encourage stories of truths to reveal themselves to us. As a whole, they point us towards a critical intersection – touching what is within each of us individually to create meaningful impact in our collective human experience.

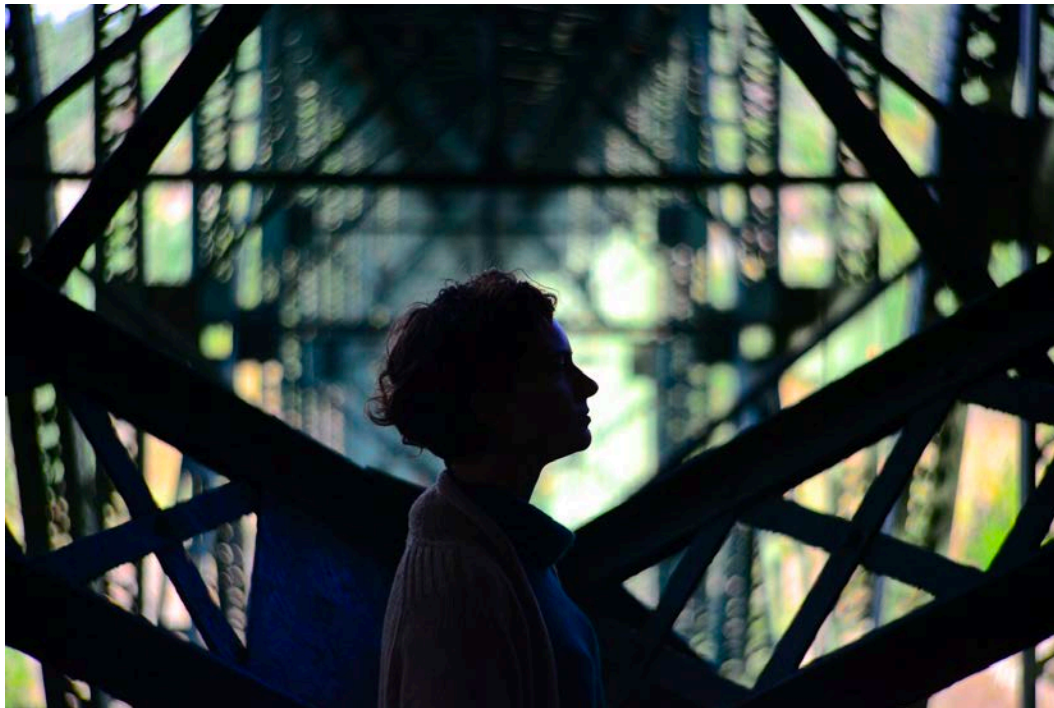
In the papers, we take a journey through the lives of scientists and student inventors in a Cambridge laboratory, and how they are working with human-centered design practitioners; we explore the Scrum, with its ceremonies and artifacts, in the everyday lives of an R&D team; and we look at how machine learning and ideas from cognitive science and anthropology can help a team work together to inform early development of new assistive personal computing technology. In each case it is the intersection of individual agency with both the 'team' and with the technologies themselves, from Post-It notes to trained machine learning models, which enable us to question the scope of what we can do, and what shapes our decision making as we work together.

## Center Frame

### Agency in the Lives of Researchers

BRANDY PARKER, *IA Collaborative*

*We try to avoid being on camera, but as researchers, are we ever really out of frame? Centered around a life-changing project that had lackluster results, this piece is a meditation on our agency, or lack of agency, as researchers. Our work gives us unique glimpses into worlds no one else is privy to, and what we experience changes us. At times, the most powerful advancement of our work is in our own lives.*



"Bridge + Brandy" photo by Evan Hanover

**Brandy Parker** is a Senior Research & Design Strategist at IA Collaborative. With a background in ethnography, psychology, and nutrition, she brings a unique whole-person perspective to both medicine and the design world. She works at the intersection of her passions for human-centered design, research, and health care.

## Self Ethnography

### Or, How I Earned My Berkeley Citizenship in an Ethnographic Journey through the Crunchy Granola and the Scientific

BETH SCHWINDT, *Autodesk*

*A researcher who used to combine “thinking + feeling” lines on a journey map found herself on the feelings frontier by widely exploring new innovations in neuroscience, psychology, and mind-body connection, alongside the resurgence in popularity of “old” ways of healing -- Chinese medicine, crystals, tarot cards. Through her self-ethnographic journey, she found that by stripping back ethnography from the measurable, the scientific, the business cases she rediscovered its foundational backbone to carefully tune into and interpret feelings. She redefines ethnography as about finding truth and not judging it --- even the parts that don’t make sense right away and asserts that believing the tiny fragments of feelings and glimmers of intuition is the future of our practice. The new science and the old wisdom revealed that feelings are the root of agency, or “the feelings we have a say in the world we live in and experience, and it is our new frontier to help people articulate the wealth of their feelings to make a world where we have a say --- even before we may have words.*



“Trapped by Trauma,” ©Beth Schwandt

**Beth Schwandt** is a researcher and strategist. As a “design mutt,” Beth found her way to research through art and historic preservation (studying dead people), and nonprofit public affairs (amplifying people’s amazing work). She’s researched hundreds of people so far in her career, including significant projects with Capital One, Autodesk, University of School and the United Way of Detroit. She studied at the Institute of Design, the School of the Art Institute of Chicago and Lawrence University. [beth@bethschwandt.com](mailto:beth@bethschwandt.com)



## Remembering the Blister

### How What Didn't Kill Me Made Me Stronger

MARISE PHILLIPS, *Wells Fargo*

*I'm an ethnographer at a major financial institution. My work became a lot more meaningful after my family and I lost our home in a devastating arson attack. In this Pecha Kucha, I tell the story of how this catastrophic fire loss forced me to reclaim my agency. Today, I channel memories of bereavement and recovery into my quest to improve experiences for customers and in my community. "Knowledge is awareness that fire can burn; wisdom is remembering the blister." —Leo Tolstoy*



“Survivor,” © Marise Phillips

**Marise Phillips** has lent insights and ideation to projects at all stages of the software development lifecycle in her 25 year career. Her specialties are design research, service design, content strategy, and facilitation of participatory design decision-making. In 2011, Marise managed a partnership with Forrester Research to bring service design practitioner training to Wells Fargo—an opportunity which has resulted in hundreds of team members across the enterprise practicing human-centered, collaborative approaches to improving customer experience. Marise holds a bachelors degree in dramatic art with an emphasis on comparative literature from UC Santa Barbara. A standout accomplishment was launching the [Oakland Sustainability Jam](#) in 2013, as part of the [Global Service Jam](#) series. Since then, she's continued to facilitate co-creation among family, friends, colleagues, and the communities to which she belongs. [marise.phillips@wellsfargo.com](mailto:marise.phillips@wellsfargo.com)

# From ‘Cool Science’ to Changing the World

## The Opportunity to Support Pre-startup Science Commercialization through Ethnography and Human-Centered Design

SIMON PULMAN-JONES, *Emergence Now*

AMY WEATHERUP, *AJM Enterprises*

*Introducing an emerging context for human-centered design work, this paper extends previous EPIC literature on startup innovation upstream into university science commercialization. It provides new perspectives on how the human-centered design community can engage with scientific models of agency to inform broader engagement with the innovation and design challenges inherent in ‘intelligent’ technologies, and offers the challenge of engaging with and developing empathy for the dispositions of scientist innovators as a new vantage point from which to reflect on our core strength as facilitators of cross-disciplinary collaboration for innovation and design.*

### INTRODUCTION

The project to engage with and humanize the culture, practices and outputs of technical disciplines (particularly computer science and software engineering) has been at the heart of the work of practitioners in the human-centered innovation and design community from the beginning. (Cefkin 2009) This paper addresses itself to a relatively new chapter in this project, as human-centered design practitioners are drawn more into engagement with science and scientists because of the increasingly significant role of science-driven emerging technologies in mainstream product and service experiences (AI, genetics, etc.), and the increasing centrality of university-based science to the industrial base of Industry 4.0 (Pollitzer 2019)

The successful propagation of human-centered innovation and design further upstream in Industry 4.0 innovation processes faces both structural and cultural challenges. Recent EPIC conferences have heard about opportunities for ethnography and human-centered design to bring more ‘meaningful innovation’ to the startup sector, but also that the metrics-centric cultures of Lean Startup and Silicon Valley venture capital constitute barriers to such a change (Haines 2014; 2016; Ries 2011). This paper’s focus goes one step further upstream than Haines, to look at how science innovation happens pre-startup.

In science innovation, moving from pre-startup to startup innovation usually means moving across the boundary between the university and the world beyond. This boundary is both a profound conceptual one, rooted in several centuries of scientific discipline formation (Schaffer 2010), and frequently also a physical one, with commercial startup activity taking place in science parks located around the periphery of university campuses.

We argue that whilst the contribution that the human-centered design community can make to providing and building innovation and design skills and capability within the startup and pre-startup science community is crucial, a more important opportunity lies in the human-centered design challenge of engaging with and understanding scientists and science culture - the motivations, dispositions and skills they bring to their innovation and



commercialization efforts – to define how best to support them in contributing more effectively to the wider innovation processes in which their work plays an increasingly important part. (Stuart & Ding 2006)

This paper's co-authors have engaged in this challenge from opposite and complementary directions: one as a serial technology entrepreneur who now runs a technology commercialization program for students and scientist 'inventors' at Cambridge University in the UK; the other as a business anthropologist and human-centered design practitioner who has worked with major global product companies to optimize their innovation processes, from science-based R&D through to product strategy and design, and who has introduced human-centered design approaches to the curriculum of the same university technology commercialization program.

Drawing on over 12 years experience of working in university pre-startup science commercialization, we present a detailed ethnographic analysis of a program designed to facilitate culture translation between the worlds of academic science and commercial application. This program brings together scientist 'inventors' with teams of student and early career scientists on projects to identify potential paths to application and commercialization. Projects aim to provide a microcosm of the startup experience, and can be seen as a form of participant ethnography, engaging with a wide range of participants in the university startup ecosystem, and with potential users and stakeholders in the world beyond.

We describe the journey that project team-members make in terms of shifting notions of scientific agency, from enchantment with the 'cool science' they are keen to get the opportunity to work on at the beginning of a project (Gell 1998), to gradually embracing broader socio-technical systems and cultural contexts (Latour 2005) as they formulate plans to bring positive impact into the world.

We consider the balance between enabling rapid adoption of templated research and design tools, and nurturing and developing the creativity, problem solving skills and dispositions that team members bring from their scientific education and experience.

We conclude by presenting a model of the motivations, skills and dispositions that scientists bring to innovation and commercialization, as an invitation for further engagement by the ethnographic research and human-centered design community.

## **BACKGROUND: SCIENCE AS INNOVATION**

This paper is written from the perspective of practitioners, with the objective of promoting collaboration between the two communities of practitioners to which the authors respectively belong – science commercialization and human-centered design. In this context, our exploration of how scientific research leads to innovation has primarily a practical objective – that of enabling human-centered design practitioners to collaborate more effectively with scientist-innovators by comparing how innovation happens within the context of pre-startup science commercialization with the best-practice expectations of commercial innovation. We thus take our definition of 'innovation' from the context of human-centered design, as a practice which addresses relevant and meaningful problems in people's lives by designing solutions delivered through products or services. We frame our investigation in this way to allow us to explore the affinities between scientist-innovators and

human-centered design practitioners in their projects to both understand and change the world.

From our practitioner perspective we do not aim to engage directly with debates about the nature of scientific knowledge production that have been developed within the fields of the philosophy of science and STS (science and technology studies, or science, technology and society) – but those debates provide important context for our discussion. Kuhn noted the processes whereby scientists’ worldviews are shaped by rigorous training via ‘exemplars’ to the currently dominant scientific paradigm (Kuhn 1962). Our scope goes beyond the processes which recruit scientists into the disciplines in which they work, to look at how they negotiate their own balance of career success and impact within science with other possibilities for impact outside it resulting from the application and commercialization of their work. A similar difference of scope is evident if we consider how Hélène Mialet, talking about Popper, draws a distinction between, “the context of discovery (the realm of imagination) and the context of justification (the realm of logic and method)” (Mialet 2012: 457). The journey that we describe in this paper starts with the context of discovery and imagination, but moves beyond the legitimization of scientific discovery within academic science in the realm of logic and method, to look at the thread which links the initial discovery to its potential for application and commercialization.

The ethnographic data that this paper is based on is structured around the journeys of individual scientists, in their science careers, and in their experiences of the commercialization of science. This may appear at odds with the shift in STS, initiated by Bruno Latour’s *Science in Action*, from a focus on scientists and science culture towards ethnographic investigation of how science works in practice through the operation of networks not only of people but of the objects and technologies with and through which they work (Latour 1987; Martin 1998). But, whilst our focus on individual scientists’ journeys is primarily a methodological device to draw out comparisons between innovation processes in scientific and commercial contexts, we do also see it as being in line with the position taken by Hélène Mialet’s reframing of Actor Network Theory in her investigation of innovation careers in an international energy company (Mialet 2009):

...if we pay careful attention to science in action, we can see at the centre of a web of practices, collectivities and technologies, an individual who acts, that is, who ‘creates’. I call this actor the distributed-centred subject. I argue that the more this actor is linked up with his institution, his objects of research, his co-workers, etc. the more potential he has to become inventive: and the more inventive he becomes, the more he seemingly distinguishes himself by his singularity as an inventor. (Mialet 2009: 257)

The scientists whose innovation journeys we explore in this paper take on the challenge of being inventive in the sense defined by Mialet – but in multiple contexts: basic science research; application of science; and commercialization. Each of these contexts involves different constellations of disciplines and practices, of organizations and institutions, and of instrumental and mediating technologies. The challenge for human-centered design practitioners is to map out what is required for scientists to successfully navigate these contexts whilst bringing a human-centered focus to their innovation efforts.

## Changing relationship between academic science and commerce

The occasion for this paper, as for EPIC's 2019 theme of Agency, is our contemporary sense of living in a historical moment in which science-driven technology innovation - through a confluence of computer science, genetics, and materials science - plays a uniquely critical role in the fate and future of humanity. For our purposes of understanding the culture and institutional forms of science as innovation, it is interesting to look back to the period during the twentieth century when the structural relationships which still underpin the relationship between science and commerce became entrenched. The British novelist and physical chemist C P Snow, writing in the late 1950's, characterized it thus:

I believe the industrial society of electronics, atomic energy, automation, is in cardinal respects different in kind from any that has gone before, and will change the world much more. It is this transformation that, in my view, is entitled to the name of 'scientific revolution'. (Snow 1959: 31)

The period that Snow was describing, in the aftermath of the intense science-driven military-industrial competition of the Second World War, was one which saw a major shift towards governments attempting to shape the basic scientific research agenda to the needs of national military and industrial strategy. Close relationships were established between science departments at research universities and military and industrial R&D labs – relationships in which science labs delivered basic science discovery and R&D labs delivered innovation (Powell & Sandholtz 2012: 385).

The emergence of the first genetics-driven biotech university spin-outs in the US during the late 1970's and early 1980's initiated a process of transformation in this relationship. The traditional divide between university science and commercial innovation has been increasingly supplanted by what Walter W. Powell and Kurt Sandholtz describe as, "interdependent and collaborative knowledge development spanning both public and private organizations," as, "biotechnology forged a recombination of scientific and commercial cultures, which led to the creation of new organizational practices and forms of discovery." (Powell & Sandholtz 2012: 386; Flink and Kaldewey 2018: 257)

Forty years on from that first biotech revolution, the hybrid of science, commerce and finance described by Powell and Sandholtz is a vital and integral component of the science and technology commercialization ecosystems which have formed around leading research universities around the world. But though university science has become increasingly integrated into commercial innovation processes and agendas, innovation within universities remains very different to commercial innovation. The aim of this paper is to provide a guide to those differences for human-centered design practitioners coming from the world of commercial innovation. So in what ways might science innovation not conform to their expectations?

The first difference that a commercial human-centered design practitioner might notice when trying to identify how science innovation happens in the university context would be in terms of process. The same forty years that has seen the rise of startup ecosystems around universities has seen commercial innovation transformed around the imperative of human-centered design, and along with this has come a convergence around a best-practice process for innovation, the underlying principles of which are deployed within branded product and

service companies across almost all product categories and industry sectors. Making people's consumption experiences in-context the organizing principle, the widespread adoption of this best-practice process within commercial innovation practice – exemplified by the five steps of Design Thinking: Empathize, Define, Ideate, Prototype, Test – has been driven by intensifying market competition, shortening product and service renewal cycles, and pervasive digitization. As a result, commercial innovation processes have become increasingly rational, organized and integrated, aligning functions and objectives across companies.

By contrast, science innovation is discontinuous, cultural, and fragmented. Unlike commercial innovation, it is not organized under a single imperative or objective. Science innovation happens through the overlapping of a set of related, but separate interests and objectives. These are distributed across complex ecosystems, whose key elements include: academic science departments; university technology transfer offices; business, design and engineering departments; student societies; and university and commercial startup incubators and accelerators. From the perspective of mainstream innovation best practice, as the 'front end' of the emergent Industry 4.0 innovation process, pre-startup science innovation might be expected to involve an open exploratory market or contextual discovery phase. This is largely absent from the current science innovation process, whose primary focus, of course, is on science discovery rather than problem or opportunity discovery. A key objective of this paper is thus to explore the conditions for science innovation to include effective problem or market discovery.

## **APPROACH**

This paper is based on the authors' auto-ethnographic analysis of their experience in the science and technology commercialization ecosystem in and around Cambridge University in the UK. Following a successful career as an entrepreneur in technology startups, in 2006 Amy Weatherup set up i-Teams, a program for pre-startup science commercialization, based in the University's Institute for Manufacturing, and serving the whole of the University<sup>1</sup>. The program consists of projects which run for ten weeks over the course of an academic term, bringing together scientists with potentially commercializable ideas with teams of post-graduate scientists to define whether or not there is a viable commercialization path (Moktar 2018). In the period during which Amy Weatherup has run i-Teams since 2006, it has hosted over 150 projects - in which over 1000 students have participated - and generated over 70 startup companies. Simon Pulman-Jones joined the i-Teams program in 2012 as a project mentor, and since 2015 has run Design Thinking workshops as a component of the i-Teams curriculum.

In addition, twenty ethnographic interviews were conducted with previous i-Teams participants during June and July 2019, exploring their experience in science innovation from the start of their science education, through their experience on the i-Teams program, to their ongoing experience in science commercialization. This sample covered a range of experience, including scientist-innovators who have generated spin-out companies but remained in academic science careers, others who have moved out of academic science and gone on to found and run startup companies, and post-graduate scientists from a range of disciplines.

## COOL SCIENCE: SCIENTISTS AS INNOVATORS

In her introduction to *Ethnography and the Corporate Encounter*, Melissa Cefkin writes of, “the drive anthropologically oriented researchers feel to work deep within the engines of the business sector.” (Cefkin 2009: 2) In this section of the paper, we explore what drives scientists to become involved in the application and commercialization of their basic scientific research, and their experience of that journey. From the perspective of the potential for collaboration between human-centered design professionals and scientists, it is interesting to note the similarities between their motivations and dispositions – particularly in relation to becoming engaged with business.

### Scientists’ innovation journey

The term, ‘cool science’, is often heard in connection with i-Teams projects. In the first instance the prospect of being able to work with ‘cool science’ motivates students to participate in the program. And the coolness of science was also something that many of the i-Teams participants that we spoke to talked about as what motivated their initial interest and involvement in science. In this section we explore how scientists make the journey from their first involvement in basic science through to becoming engaged in commercialization: what leads them, usually in the absence of any formal objectives or process, to follow this path.

#### *Stage one: engagement in basic science research*

The dominant theme when our i-Teams science-innovators talked about what first motivated their involvement in basic science research was creativity and imagination – frequently framed around a heightened visual sense of entities, structures and phenomena unfolding in three-dimensional space.

One of our research participants, a molecular biologist, talked about why she was attracted to the work of the lead scientist whose team she aimed, successfully, to work on after completing her PhD: “It was novel. It was imaginative. He managed to turn the field around a few times during his career. He will embark on risky stuff that no one else is doing. He’s just driven by his interest and is not afraid of jumping into something that might give fruit or might not.” The way in which the work was imaginative became clear from her description of one of the team’s main discoveries:

We were doing a lot of fluorescence in situ hybridization. That’s detecting genes, all their transcripts, in fixed cells under the microscope. You can see shiny dots to detect various relationships between molecules in the nucleus. And we just by chance encountered the phenomenon that genes came together when they were being active. They were just very close in 3D in the nucleus. If you’re detecting one gene and another gene in two different colors, in many cases in the cell they were on top of each other – one green, one red, making yellow. So we started looking into this because we thought, that might be because there is a 3D architecture of the nucleus that is important for how transcription in the nucleus functions.

Here we see some key characteristics of science-innovators that are of interest from the perspective of human-centered design practitioners interested in engaging with science innovation. Firstly, we see the intensely visual nature of the scientific imagination. (Ihde 2000) In this case, a technique which caused molecules to fluoresce in different colors when viewed under the microscope revealed an unexpected relationship between when genes became active and their position in 3D in relation to other genes. The scientist is primed to recognize when something ‘looks’ different to what existing knowledge and models of the phenomena would lead one to expect. Their attention is focused, as it were, at the periphery of known patterns – looking for anomalies which might signal a disruptive innovation in scientific knowledge. In this case, this visual observation led to important discoveries about how genes operate and organize themselves within the nucleus, which in turn has powerful implications for optimizing how drugs can target diseases. Secondly, we see the extent to which basic science is dependent upon and driven by technological innovation – in this case the fluorescence approach which made the phenomenon of 3D gene architecture evident. (Ihde 2009: 34-35)

The example above dramatizes the extent to which scientists are expert observers. Basic science knowledge and hypotheses form the base context for their work, but the substance of the daily work of experimental science is an embodied process of registering significant patterns and anomalies (using the observer’s body as the primary instrument), mediated by technologies (in this case the lab, the microscope and the fluorescence technique). And here we might start to recognize affinities between scientists as practitioners and human-centered design practitioners. Science practitioners are on the one hand embodied participant observers (ethnography) and on the other artisanal manipulators of technology (design).

What makes ‘cool science’ cool is this combination of delightfully complex configurations of phenomena in new and unexpected patterns, and the scientist’s sense of involvement at the heart of that delight as the registering and recognizing imagination. This constitutes stage one in the scientist’s innovation journey, anchoring her engagement in basic science.

#### *Stage two: from basic science to application context*

Our purpose is to follow the thread of motivation and rationale that leads scientists beyond their engagement in basic science research towards something which might in the end have impact in the world outside of academia. This next step is a small one, but an important one, as it is the step which involves reaching out beyond the lab. We can pick up the 3D gene architecture example above to unfold the rationale.

The team had identified that parts of the genome came together in 3D space in the nucleus when the genes were active and regulating gene output. They had identified a previously undiscovered phenomenon, but that identification was of no value in itself without an understanding of why it happens. In this case, the only way to discover what this 3D mobilization of genes was doing was to leap out of the context of the lab and make reference to a Genome Wide Association Study. Genome Wide Association Studies link genetic variants with large populations of individuals for the purpose of identifying associations between genetic variants and individual traits. This would allow the team to

identify whether the gene configurations which they had observed in the lab could be linked to any diseases or other traits in the human population.

This is the first small step along the path from basic science to application and commercialization. It involves identifying a context in the world where the effects of the scientific phenomenon in question might be located or identified. As such this is very much application with a small 'a' – as the primary focus is not on the application context in the world, but rather to use that application context to validate hypotheses about scientific phenomena observed in the lab.

But this small step is often the one at which the scientist-innovator's imagination is captured by the prospect that the discovery that they have made in the lab might be able to do something out in the world. Some of our participants talked about their investment in their 'cool' basic science discovery being like that of a parent's investment in children. Up until that point they had not expected the focus of their work to extend beyond basic science. But now a mixture of curiosity and pride drove them on to discover what their 'offspring' might be able to do to make a positive contribution in the world.

### *Stage three: from application context to potential impact*

For many scientists, in many fields of science, it may be sufficient for them to stop at the previous stage, in which they have engaged with an application context in the world in order to return back to their basic science context in the lab with knowledge that allows them to progress their basic science agenda. Pressure to publish within their field may militate in favor of this, with little incentive to explore application potential in the world further.

But many scientists, of course, do make the move from identifying an application context to exploring potential for their new scientific knowledge to have impact in the world. The experience of one of our i-Teams scientist-innovators provides an example. He is a chemical engineer who runs a team of scientists at Cambridge University working on metal-organic frameworks. The metal-organic frameworks are of scientific interest because of their capacity to capture and absorb other molecules within their complex molecular structure. In effect they can function like extraordinarily powerful sponges. The work of the team is primarily focused on advancing basic scientific understanding of this phenomenon, though the ability of new materials to absorb large volumes of other liquids or gases has evident practical application. It was an accident which opened up the possibility of significant impact in terms of practical application in the world.

One member of the team was conducting a series of experiments in the lab to test the absorbency capacity of different metal-organic compounds. This involved trays of samples of the compounds being left in ovens overnight to dry, to finish them before testing. The scientist returned the following morning to discover that he had forgotten to put one of the trays in the oven, meaning that it had spent the night in the open on the bench. He called in his boss to tell him. The team leader noticed that the compound that had been left out of the oven had dried differently, forming a smooth-surfaced pellet rather than a powder. Intrigued, he organized tests of the absorbency of the pellets, and much to his surprise it turned out that it was a factor of ten greater than what would be expected. In this case the technical advantage was so great that the potential impact across a range of industry sectors and application areas was immediately apparent, and the innovation process moved on to

patenting, validation of potential application use cases, and eventually to formation of a spin-out company pursuing applications ranging from bulk gas transportation to drug delivery.

In this case the path from basic science research to potential application impact was unexpected, but relatively straightforward when it presented itself. A ten times performance advantage is what is generally held to be required if a scientific-technical advance is to have a chance of being viable in market once investment and time to market are taken into account.

This is the stage at which the science innovation process becomes more dependent upon chance contingencies. At the previous stage, the scientific literature will provide the link to application contexts in the world, with which to validate experimentally derived hypotheses. At this stage the process is more dependent upon the scientist's acquaintance with performance benchmarks of scientific technologies in application in the world. Startling leaps in technical performance, as in the above example, may be sufficient on their own to prompt exploration of patent potential via the university technology-transfer office, but often this will not be the case.

There are many areas in which performance advantages of new scientific technologies in real-world applications can be hard to judge. Drug discovery is one such area, in which novel approaches to combatting the mechanisms of diseases may offer theoretical potential which can only be fully tested after a long process of clinical trials. In this case, what motivates scientists and the teams who become involved in commercialization efforts is strong and detailed understanding of the significance and potential value, in both human and market terms, of the need which could be addressed.

Whilst medical science may involve this intrinsic element of human-centricity (Schwartz et al 2016), there are many areas in which science innovation does not have such a direct link to meaningful problems in the world – areas in which if a new scientific technology does not have an immediately apparent gross performance advantage, potentially valuable opportunities for impact in the world may go unaddressed. It is therefore at this point in the science innovation process that there is the most striking divergence from commercial human-centered design best-practice - which puts meaningful problems in the world at the heart of the process.

This problem is recognized within the university sector, and addressed in a range of ways, including, but not limited to: educational courses and curricula addressing areas of application relevant to a given discipline; research funding calls by government funding bodies focused on marshaling multi-disciplinary responses to deliver impact against specific problem agendas (Shneiderman 2016); institutes or centers established within universities whose aim is to raise awareness and mobilize university assets (research, intellectual property, etc.) around problems in specific domains or topics (Rogers et al 1999); knowledge-transfer offices which facilitate external access to university expertise; student clubs or societies mobilizing activity around specific areas of interest or policy agendas.

These activities constitute the rich and complex informal system through which the university sector's potential impact in the world beyond the academy is mediated. As a relatively informal and unstructured system it is highly dependent upon the personal experience and social networks of individual students and academics to make connections between potential solutions generated within the academy and relevant problems out in the world.

Analysis of the effectiveness of university systems in aligning university knowledge creation with potential areas of impact in the world is beyond the scope of this paper. What



we are able to address is the experience of scientist-innovators as they pursue their careers within this system. Our experience through the i-Teams program, and our research on the career experience of scientists who have participated in the program, bears out the extent to which making links between potential solutions generated in the course of basic science research and relevant problems in the world is highly dependent upon chance and contingency. (Indeed i-Teams is designed as an approach to make these links in a more systematic way.) The experience of many student participants in i-Teams is that they remain unaware of the potential for the scientific knowledge and expertise which they are developing during their studies to be harnessed through innovation and commercialization approaches to solve problems in the world, until they arrive at a junction in their educational or academic career which prompts them to investigate options for the next step in their career.

## **CHANGING THE WORLD**

We have traced the journey scientist-innovators make from their first enchantment by the coolness of science through to the realization that their scientific ideas may have the potential for impact in the world beyond academic science. So far, we have framed this journey from the perspective of the individual scientist's investment and involvement in scientific exploration and discovery. The central role of the individual scientist in university-based science innovation is one critical way that science-innovation differs from commercial innovation, which is something that we will return to later in the paper. At this stage, though, we want to bring a different frame to the discussion – that of agency.

Scientists who become interested in pursuing the potential impact that their ideas can have in the world inevitably find themselves confronted by making the transition from changing science, to changing the world. In this section of the paper we will chart this journey in terms of different fields of agency, through the unfolding of a pre-startup science commercialization project on the i-Teams program.

### **The science commercialization journey**

The i-Teams program at Cambridge University was launched in 2006 to address a gap in pre-startup science commercialization provision at the university. No provision existed at the time for post-graduate students who did not yet have an idea for a startup company to gain exposure to science commercialization approaches. Existing science and technology commercialization and entrepreneurship support within the university was predominantly in the form of business plan competitions, incubators and accelerators. These assumed that those entering the competitions or programs already had an existing startup business concept as their starting point, thus excluding many post-graduate students who were at an earlier stage of exploring science commercialization. From the outset, therefore, the i-Teams program placed itself further upstream in the innovation process. Whereas the business plan competitions, incubators and accelerators are focused on taking a startup idea, getting it into shape and making it work, i-Teams focuses on the key question of whether or not a viable commercialization path exists and is worth pursuing.

i-Teams projects are rooted in a symbiotic relationship between two stakeholder groups: post-graduate students looking to learn about science commercialization, and scientists

(known within the program as ‘inventors’) whose new scientific technologies provide the basis for the projects. The post-graduate student teams get the experience of working with leading-edge scientific technologies and learning about the realities of exploring and defining commercialization paths; whilst the inventors benefit from the focused work of a capable and committed team of young scientists to uncover new opportunities for their technologies to deliver impact. The inventors also have access to learning by interacting with the student team as the project develops - some choose to benefit directly from this to increase their own skills and knowledge (these are usually the ones thinking of making a more active transition out of academia), while others treat it more as an external consulting project with results delivered to them at the end (these are usually the ones dedicated to an academic career path). Projects therefore aim to provide both a valuable learning experience for the post-graduate students, and a successful outcome for the inventors in terms of clarification about the commercialization potential of their ideas. The balance between these twin project objectives is overseen by project mentors. Mentors are chosen for projects based either on their experience of commercializing similar technologies in related industrial sectors, or on their experience in running innovation and commercialization projects – or a combination of both.

Projects represent a significant time commitment for the team members. Over the course of ten weeks, the teams convene for lectures and working sessions one evening per week with the mentor and the core i-Teams staff, and co-ordinate significant amounts of both team and individual work ‘offline’ between those weekly meetings to conduct research, fieldwork and analysis. Participation by the inventors varies, with some attending all the weekly meetings with the teams, and others joining only for key milestone meetings at the beginning, middle and end of the project. There are three different i-Teams programs which run in parallel, each with a different focus: Innovation i-Teams, Medical i-Teams and Development i-Teams<sup>2</sup>. Each of these programs comprises three teams of seven student team members. Interaction and learning across the three teams, as their projects develop in different ways, is an important component of the program.

*Experiential ethos: challenging the certainties and structures of university science with the complex realities and uncertainties of the outside world*

The ethos of the i-Teams program is determinedly open, flexible and experiential, as opposed to didactic, instructional and templated. It seeks not to provide theoretical training in science commercialization, but to expose both team members and inventors to its realities. A structure of objectives and milestones is provided for the project, but teams are largely left to discover for themselves how best to organize and manage their efforts.

Project outline:

1. Inventors introduce their technologies to their i-Team. Teams interrogate the inventors to ensure they understand the technologies in terms of technical characteristics and performance, unique intellectual property (IP) and benefits insofar as the inventor currently perceives them.
2. Teams brainstorm as broad as possible a range of potential application areas for the inventor’s technology.

3. Teams cluster and prioritize potential application areas and assign tasks within the team to research technical and business viability and stakeholders to approach.
4. Teams contact relevant stakeholders (academic and industry experts; B2B or consumer end-customers, etc.) and conduct interviews and/or fieldwork.
5. Teams refine value propositions for the technology and develop commercialization recommendations and roadmap. This may also include identifying technical milestones that need to be addressed before commercialization efforts can proceed.
6. Final presentation of commercialization plans to members of the Cambridge innovation and investment community.

This process unfolds over the ten week period of the project, with the team's work loosely guided by the mentor. Steps 3, 4 and 5 are largely iterative, as teams continually develop and revise their hypotheses and value propositions.

The weekly evening sessions for the project consist of team working time and lectures and workshops given by experts in technology commercialization and innovation. Though the topics covered in the lectures and workshops are intended to be relevant and useful for the teams in supporting their work on their projects, they are not directly instructional, and they do not provide structured, templated processes or tools to be used by the teams. The intention, rather, is to expose the teams to the underlying principles and realities involved in science and technology commercialization and also to expose them to different areas of professional expertise and experience. Rather than being trained – provided with a set of skills and tools tailored to the task in hand – the i-Teams members are offered the opportunity to become acquainted with the world of science and technology commercialization and to be inspired – or not – to pursue it further in their careers.

This open-ness is at the heart of the i-Teams ethos, and an important aspect of the program's objective to provide a microcosm of the startup experience within the ten week capsule of the project. In contrast with other types of pre-startup commercialization provision, which work towards fixed deliverables such as the business model canvas or a startup pitch, the i-Teams program is agnostic about project outcomes and deliverables. What might seem like a negative outcome – where a team identifies that there is no viable commercial opportunity for the inventor's technology (because its benefits are not relevant and compelling, or because similar or better solutions already exist) – is a very useful outcome both for the inventor, who may be able to revise and adapt their solution, or re-focus their efforts in other areas, and for the post-graduate student team members, who learn the difficulty of achieving all of the criteria required for successful commercialization, and the value of identifying weaknesses in value propositions at an early stage in order to re-focus scarce resources.

The open, experiential nature of i-Teams projects can be seen as a form of participant ethnography. Indeed, one of the core objectives in the design and running of the i-Teams program has been to enable culture translation between the world of academic science and the world of technology commercialization. i-Teams participants are exposed to new cultural contexts – from technology commercialization professionals and their practices, to the realities of startup team formation and collaboration, to industry experts and processes, and to consumption contexts in which their assumptions and value propositions are tested – and they go through the experience of making sense of those new cultural contexts in much the same ways that an anthropologist or ethnographer does in the course of their fieldwork – by

registering new terms, new concepts, new language, new practices in relation to their existing cultural frames of reference and figuring out how to translate them.

*Encountering new fields of agency: the i-Teams project journey*

We have outlined the i-Teams project process in terms of its high-level objectives and milestones, and now turn to examine the process from the perspective of the different fields of agency with which the team members become acquainted as the project unfolds.

*Phase One: Cool Science Enchantment*

If the i-Teams project experience can be seen as an ethnographic encounter with the realities of science and technology commercialization, with the project being a liminal space between scientific and commercial cultures, the start of the project takes place firmly within science-culture. The first evening session involves a presentation by the inventors to their teams about the new science-technologies they hope to commercialize, with team members invited to interrogate the inventors about their technologies. It is made clear to the teams that it is crucial that they understand not just the technical, scientific details of the technology, but also the ways in which those technical features and characteristics could translate into benefits of relevance in potential contexts of use. Despite this injunction, there is usually a significant pull at this stage in the project towards detailed discussion between the team and the inventor about the technology in purely scientific, technical terms. Of course, this is both understandable and necessary, as the teams need to be confident that they properly understand the scientific and technical foundations of the technologies that they are working with – and that they will need to discuss with a range of expert and non-expert stakeholders later in the project. But the gravitational pull of purely scientific discussion at this stage of the project can also be seen as a result of the power of the science culture to which the inventor and the team members belong<sup>3</sup>, and to the model of scientific agency at the heart of that culture<sup>4</sup>.

To understand how this model of agency plays out within the interactions and discussions of the team at this point in the project we can return to the earlier example of the discovery of new ways in which parts of the genome mobilize in relation to each other in three dimensional space as they become active. In terms of observation within the lab, and communication of those observations first to other members of the team and subsequently to other scientists through broader conversations and publications, the phenomena visible through the microscope – in this case highlighted by fluorescing in different colors – constitute a self-contained field of agency. This field of agency comprises agents – scientific phenomena (molecules, genes, fluorescence, etc.) – whose agency is evident through their interactions with and effects on each other.

But it would be a mistake to regard this field of scientific agency to be limited only to the phenomena under observation in the lab. The scientists themselves also participate within this field of agency as the register of the scientific phenomena under observation, through their senses, and as organizers of the phenomena through their manipulation of lab tools and technology. With this in mind it is possible to appreciate how powerful is the impetus towards technical scientific discussions between the inventor and the team members during the early stages of an i-Teams project. Fields of agency define the entities and the

capacities that matter within a particular cultural context. The scientific-technical discussions about the inventors' technologies are a vehicle for expressing and reproducing the team's participation in science culture with the inventor.

We might draw a parallel with what the anthropologist Alfred Gell terms, "technologies of enchantment," in the context of the at once simple yet beguilingly complex decorative prows of the canoes used by Trobriand islanders on their Kula expeditions:

I am impressed by works of art in the extent to which I have difficulty... in mentally encompassing their coming-into-being as objects in the world accessible to me by a technical process which, since it transcends understanding, I am forced to construe as magical. (Gell 1992: 49)

Here the aesthetic technology of the intricate Trobriand canoe prow designs imposes its agency on observers, subjecting them through its powers of enchantment. And just as the technical virtuosity of the Trobriand designs transcends understanding and thus seems like magic, to some extent the scientific technicalities being discussed between the inventor and the i-Team, whilst they remain only partially explained and understood, can also be seen as, "a technical process which... transcends understanding" and thus invested with a kind of magic, which commands attention. Indeed, given the multi-disciplinary nature of the i-Teams, with team participants drawn from a range of science disciplines both directly and more indirectly related to the inventor's technology, there will always be a range of levels of technical comprehension of the technology within the team, with some team members relying on a more approximate, gestalt understanding.

The first phase of the i-Teams project thus operates to some extent within this realm of 'enchantment' by the power of scientific agency. The aim of the i-Teams program is to break out beyond the limits of scientific agency to confront the teams with additional fields of agency with which their technology must engage in the world beyond.

#### *Phase Two: Loosening the Bonds*

In the second week of the project, having been briefed on the inventor's technology, the team undertakes a brainstorming exercise to generate a broad range of ideas about potential application use cases for the technology, aiming to broaden the scope as far as possible beyond the inventor's in-coming assumptions, to consider different end-users, use cases, usage contexts, product/service categories, or industry sectors. Adopting standard brainstorming rules and best-practices, the aim is to encourage the team's thinking to diverge as much as possible, and to embrace speculative leaps.

Though this form of brainstorming is common practice in many commercial work contexts, and absolutely routine in human-centered design practice, most i-Teams team members will not have been exposed to it during the course of their scientific education and careers. It represents an important first, small disruption of the norms of science-culture that the teams and inventors bring to the projects, and makes a first shift in terms of agency.

In terms of scientific agency, the propositions which inventors bring into i-Teams projects commonly make clear links between technical performance characteristics of their new scientific technology, often substantiated by academic publications and/or patent applications, and the application use-cases which they believe represent a potential

commercial opportunity. Scientific agency is central to these propositions: the science has these technical features and capacities, therefore it is able to deliver these significant performance improvements when applied. The speculative nature of the brainstorming process shifts the conversation away from strong and direct links between scientific agency and resultant product or service benefits, and makes a first step towards recognizing that successful innovation and value proposition development will involve a dialogue between scientific agency and other forms of agency located in potential application contexts. To say that the technology “might” be relevant in a different application context to the one(s) initially defined by the inventor is to begin to open the team up to the fact that meaningful propositions are defined by more than scientific-technical specifications. There is also an aspect of starting to realize that finding the best value propositions may not be an obvious element that derives straightforwardly from the technical specifications, and that the process of identifying real-world applications therefore encompasses a creativity and element of exploration of its own.

It is important to note, also, that at this stage in the project the team is starting not only to make the first shifts in terms of the fields of agency which they embrace as relevant to their innovation task, but also to make shifts in terms of their experience of their own agency as scientists. The open, collaborative, inclusive nature of the brainstorming as a mode of team working represents a significant change for many of the post-graduate scientist team members from their more structured experience of scientific lab team work. Indeed, many i-Teams participants say that one of their primary motivations for wanting to join the i-Teams program is to experience a more collaborative form of team working.

In supporting these two different types of shift in agency – in terms of scientific versus other contextually embedded fields of agency, and in terms of the scientists’ own agency – the i-Teams project approach works with science innovation as an embodied practice. Just as experimental lab science is an embodied experience with the scientist at the heart as register/observer, the process of translating between science culture and commercialization during an i-Teams project is an embodied, experiential process.

### *Phase Three: Crossing the Threshold*

The third phase of an i-Teams project might on the surface seem the most straightforward and mundane, but in many ways it is the most critical. Having defined and prioritized a set of potential application areas to investigate, the next step for each team is to engage with potential stakeholders to explore the contextual factors in each application area which will determine the potential to deliver a successful value proposition based on the inventor’s technology. The first step in this process is to set up conversations – with experts in relevant industry sectors, or with potential business or consumer customers.

Just as the brainstorming process is a new and unfamiliar experience for many i-Teams participants, the prospect of conducting conversations with unfamiliar people outside the university also presents itself as a new challenge. Recognizing this challenge, the i-Teams program includes a workshop session on conducting successful conversations, which introduces the team members to effective questioning and listening approaches and allows them to explore and manage their own conversational habits via role-play exercises. The workshop frames the conversation challenge as both a theoretical and technical one – in terms of effective question types and investigative approaches, and also as an emotional and

psychological one – in terms of putting oneself in a position to conduct the interview in a relaxed, open and confident manner.

This stage in an i-Teams project is commonly the most difficult one. Teams contact large numbers of potential contacts via email and social media. There is an anxious period of waiting for responses, which frequently come more slowly and in lower numbers than the teams hope. After the more straightforward activities of the early stages of the project, this first attempted encounter with the outside world introduces a sense of jeopardy into the projects. Will sufficient people respond? Will team members be able to execute the conversations effectively? Will the right kind of people respond, and will the conversations with them provide insights that help the project progress positively?

During this part of the project it is natural for some of the teams to become discouraged if things do not go quite to plan. The team mentors and the i-Teams staff are required to provide encouragement and coaching about additional strategies for making successful contact with useful informants. However, what might seem at times like an Achilles heel of the process – the unpredictable dependency on timely response from external contacts during a time-constrained project – is actually a crucial experiential component of the process. It is at this stage of the project that teams start to have some feeling of actually being in a startup: through pressure of time ebbing away whilst unpredictable external factors impede progress; through the need to challenge oneself by taking on new and unfamiliar roles and skill-sets; and through the need to collaboratively define and assign work roles and tasks, and depend on team mates.

This phase is a liminal one, which dramatizes the process of crossing the threshold to take the science beyond the confines of the university – and as with the previous phase, for the team members, it is an embodied experience which makes a further shift in their role as researcher-creators.

#### *Phase Four: Encountering other Actors*

i-Teams projects involve a range of ways of engaging with stakeholders and potential users or customers, from email exchanges, to phone conversations, in context interviews and visits, and focus groups and co-creation sessions – depending on the nature of the inventor's technology, and the products or services envisaged. But it is the phone conversations which are usually the team's first experience of testing the inventor's proposition which are most significant in helping the team make the leap from thinking of the proposition in technical or scientific terms, to starting to discover other fields of agency – other actors and forms of agency. This will typically take the form of a conversation with an R&D scientist or product manager working for a company that is a potential user of the new technology – either within their own industrial processes, or within their products or services. The conversation may start with a discussion about the technical features and intended benefits of the inventor's technology, but when the conversation goes well it will then open out into a broader discussion in which the external expert starts to introduce a range of contextual factors to qualify the nature of the opportunity – from requirements, dependencies and performance and cost benchmarks within a relevant industrial process, to the competitive landscape for comparable solutions, or the needs and constraints of end-users or consumers. It is through these conversations that the teams first become acquainted with the additional fields of agency – industrial processes with their interrelated technical systems and human

actors; landscapes of competitive solutions; end-users and consumption contexts - with which the scientific agency of their technology must engage.

These conversations unfold differently than if the i-Teams participants were experts in human-centered design qualitative interview techniques. Rather than the interviewer guiding the interviewee through a discussion which reveals the contextual factors, relationships, meanings, etc. that comprise the anatomy of the product or service experience, in these interviews the balance is more towards the interviewee volunteering details about the usage and/or consumption context in order to offer advice about why, or why not, and how, the technology solution that the i-Team member is introducing might work, and might be adapted or improved. Though viewed in terms of human-centered design best practices, these conversations may not seem ideal, in terms of the step-by-step experiential learning process of the i-Teams project there is a valuable logic, consistent with the embodied, experiential nature of the earlier project phases. To conduct these conversations in the style of expert human-centered design interviews would require the scientists to bring to the conversations a prior model of what they want to discover. Instead, what happens is that the i-Teams participant encounters the new fields of agency as they are revealed by the interviewee, and in most cases needs to be willing to use this information to challenge and adapt their own assumptions and preconceptions. It is an experiential process in keeping with the scientist's discovery mode in the laboratory, enabling the scientists to extend the scope of their investigation to include additional fields of agency beyond the scientific agency which dominated it at the outset.

#### *Phase Five: mapping fields of agency interacting over time*

The final phase of the project, focused on articulating plans and recommendations for how the inventor should proceed with commercialization of the technology, is underpinned by the concept of mapping out dependent activities over time. This is a process which begins as soon as the team starts reporting back at each of their regular meetings on the findings from their interviews and fieldwork. With each member of the team investigating a different application context for the technology – or different aspects of the favored application context – the discussions at these meetings unfold as an implicit evaluation and prioritization of different aspects of the commercialization opportunity. Inevitably, the conversation turns to questions of sequencing. Which potential application area is most primed for adoption of the value proposition? Which user or consumer group is most likely to adopt first? Which opportunities require lengthy processes of proof of concept, technology development, or regulatory approval? As conversations with expert stakeholders and end-users, and other fieldwork, continues over the final weeks of the project, the team starts to form its point of view about what its final recommendations to the inventor will be, through an iterative process of value proposition refinement and opportunity prioritization.

The shift towards thinking in terms of roadmaps and processes unfolding over time is reinforced at the start of the second half of the project by a Design Thinking workshop focused on developing a journey map for one or more of each team's potential value propositions. The simple device of considering how a product or service experience varies over time in terms of its contexts, constraints, dependencies, etc. is experienced by the teams as a powerful new way to reveal the challenges and opportunities involved in successful delivery of the value propositions they are considering. This marks another important shift



away from the scientific model of agency which dominates at the start of the project. Whereas within the scientific model, processes under consideration are necessarily specific and strictly defined and controlled in order to isolate the characteristics and effects of scientific phenomena (a defined field of agents and agency), journey mapping introduces the teams to a mode of working which aims to be as open as possible to discovering any and all possible contextual factors which might influence the successful delivery of a value proposition unfolding as a process over time. This openness embraces the discovery of new potential agents and agency within the experience (e.g. additional user or consumer stakeholders; other technologies, services or processes on which delivery of the value proposition is dependent; etc.) as the route to successfully realizing the opportunity to deliver impact through the inventor's technology.

Projects conclude with the teams presenting commercialization plans and recommendations for their inventor's technologies to an audience drawn from Cambridge's science and technology commercialization community. These recommendations usually take the form of prioritized application areas with revised and refined value propositions and associated business models. It is common for more than one application area to remain in consideration, and for the different options to be represented in the form of a roadmap which articulates how the delivery and business models for each value proposition will combine over time to deliver a sustainable route to realizing the full potential impact of the technology. It is common for projects to result in ongoing conversations with potential customers, partners or investors which will provide initial impetus for the inventors to embark upon the roadmap identified by the team. (Not all projects are able to identify potential commercialization roadmaps: in these cases the team may be able to specify additional technical development and proofs of concept that are required first.)

Presentation of commercialization roadmaps is a dramatic enactment of the journey that the teams have made from the start of the project, focused on the technical details of a new scientific technology, to the point at which the technology has taken its place in a story alongside many other actors and fields of agency. The commercialization roadmap, as with the journey maps that the teams create, is a powerful tool for enabling the scientists to take account of and navigate between the multiple contexts, and multiple fields of expertise. Within it they represent input from diverse perspectives, which might include scientists, technologists, industrial process engineers, users, customers, patients, marketers, intellectual property experts and investors. The roadmap provides a vehicle for holding together what might seem incommensurable perspectives, just as the overall process of the i-Teams project itself provides both team members and inventors with an embodied experience of how they might be able to inhabit not just the role of scientist, but also the other broad range of roles required to embark upon the commercialization of science through startups.

The experiential nature of the i-Teams project process does not seek merely to bolt on new disciplinary perspectives and skill sets to its scientist participants, overlaying them with human-centered design, entrepreneurship and business management skills. It is designed, rather, to give them hands-on experiences and increase their skills and awareness of the complexity of the commercialization process by doing so. It builds on their existing expertise and creativity, making as much use as possible of the skills they already have to give them confidence in their own ability to adapt to new contexts outside of academic research. It aims to nurture the agency of the scientist as researcher and creator, and allows them to expand the scope of their ambitions, and of their areas of interest. It exposes them to new

ideas in a way that allows them to realize that commercial questions can be just as engaging as (or even more engaging than) scientific ones.

## OPPORTUNITIES TO SUPPORT PRE-STARTUP SCIENCE COMMERCIALIZATION

Earlier in the paper we posed the following question: In what ways might science innovation not conform to the expectations of human-centered design practitioners coming from the world of commercial innovation? We can broadly characterize the differences thus:

**Table 1. Differences Between Science Innovation and Commercial Innovation**

	Science Innovation	Commercial Innovation
<b>Process</b>	complex, obscured, accidental science technology IP-centered	rationalized, iterative-phase-based human-centered
<b>Collaboration</b>	informal, opportunistic, local individual-based	organized, aligned, integrated functional team-based
<b>Culture</b>	value generation depends on and reinforces science culture	organizational and disciplinary cultures recognized, but managed, and subordinated to objectives
<b>Objective</b>	impactful scientific knowledge	brand / lifetime customer value
<b>Primary Delivery Vehicle</b>	scientist	value proposition

It might be tempting to read the differences outlined above as evidence that science innovation is at a similar stage of development along a pathway towards human-centricity as technology product companies were thirty years ago. But this would be to mistake the fact that science innovation is, necessarily, driven by different imperatives, towards different ends. Whilst university science is increasingly becoming the de facto front end of emerging Innovation 4.0 innovation processes, it cannot become fully submitted to that role.

The ‘impact’ imperative which shapes much of the scientific research agenda through the funding process is a nuanced concept with some ambivalence at its heart. Under this imperative scientific work must be linked to impact, but not fully committed to delivering impact. The positive impact of scientific knowledge in the world remains a secondary effect of delivering impactful scientific knowledge.

In the concluding sections of the paper we will reflect this dualism by considering, firstly, how ethnography and human-centered design can support science innovation in becoming more human-centered and more integrated and aligned with commercial innovation processes, and secondly, how ethnography and human-centered design can support scientists in their own pursuit of impact.

## Supporting University Science Innovation

Table 2 maps the science innovation journey described in this paper against the main elements of university technology commercialization ecosystems through which ethnographers and human-centered design practitioners might be able to engage, and indicates where human-centered design capability is currently most likely to be found.

**Table 2. University Science Innovation Journey**

	Basic Science Discovery	Application Context Identification	Impact Potential Identification	Application Validation	Value Proposition Development	Business Model Development
Science Depts.						
Innovation/ Design/ Business Schools				X	X	X
Humanities & Social Science Depts.						
Student Societies					X	X
Policy/Issue Centers & Institutes			X	X	X	
Technology Transfer Office				X	X	X
Investors (Angels, VCs, Corporates)					X	X
Incubators, Accelerators					X	X
Startups					X	X

*X = areas where (often limited) human-centered design support for the process currently exists*

It can be noted from Table 2 that human-centered design support is so far present mainly in the later stages of the science innovation process. This is where existing support for pre-startup commercialization tends to become engaged, usually at the point at which the concept for a potentially commercializable technology application has already been developed, which inevitably limits ability to maximize the human-centered potential of the original scientific idea. The opportunity remains, therefore, to engage with the earlier stages

of the science innovation process outlined in this paper to support a richer alignment between emerging science-driven technologies and meaningful problems in the world.

There are two main dimensions to this challenge: the structural and cultural complexity of university science education; and the availability of viable business models for delivering human-centered design support at this stage of the process.

Existing vehicles for intervening within the complex ecosystem of science innovation may provide useful models. Notable amongst these is Stanford's D-School, which since 2005 has made human-centered design accessible as a core practice competency across the university, and which in addition to facilitating science's engagement with meaningful problems, has also explored the potential of introducing Design Thinking principles to the science discovery process itself (Yajima 2015). University initiatives advancing the agendas of development and sustainability also provide successful models for engaging with the basic science research agenda. Examples include the Stanford Center for Social Innovation ([www.gsb.stanford.edu/faculty-research/centers-initiatives/csi](http://www.gsb.stanford.edu/faculty-research/centers-initiatives/csi)), and the Centre for Global Equality's Cambridge Inclusive Innovation Hub, hosted in the University of Cambridge by the Department of Chemical Engineering and Biotechnology ([www.centreforglobalequality.org/inclusiveinnovation/cambridgeiifhub](http://www.centreforglobalequality.org/inclusiveinnovation/cambridgeiifhub)). Initiatives such as these have used the UN Sustainable Development Goals as a persuasive vehicle for mobilizing academic research efforts. Ethnography and Human-centered design practitioners might look to learn from and build on this success to promote engagement with a broader scope of meaningful human problems beyond the development and sustainability agendas.

Developing business models for this work is the other challenge. In her 2016 EPIC paper, Julia Haines proposed that the role of Ethnographer in Residence might be adopted by venture capital funds, on the model of the Entrepreneur in Residence role, to support more meaningful and thus more commercially successful innovation. (Haines 2016: 196) Adoption of ethnography and human-centered design in the startup sector may prove a useful bridgehead and case study to promote adoption further upstream in the process – but there is no doubt that this represents a significant innovation and business model design challenge in itself.

We therefore propose the following agenda to advance the cause of ethnography and human-centered design support for science innovation:

1. Ethnographic research to map science innovation journeys through the complex organizational structures and cultures of this ecosystem
2. Human-centered design work to translate that understanding into journey maps as a resource for mobilizing collaboration and designing support solutions
3. Collaboration with stakeholders in science innovation ecosystems to innovate business models for the inclusion of human-centered design activities

## **Supporting Scientist Innovators**

Our ethnographic vantage point for this paper has been from the perspective of a pre-startup science commercialization program in Cambridge University, i-Teams, and the experience of the scientists that the program supports. And so our focus has been on the journeys that those individual scientists make from their first interest in learning about

science, through scientific research, to discovery of potential for impact in the world, and on to beginning the process of making that impact a reality through the i-Teams pre-startup commercialization program. In terms of the differences between science innovation and commercial innovation outlined in Table 1, we can see that viewing science innovation from the perspective of the individual journeys of scientists is quite appropriate. For one of the fundamental differences between science innovation and commercial innovation is that whilst commercial innovation is organized so that the solutions that it creates are seen as the product of abstract functional entities (teams, departments, divisions, brands) rather than individuals – with market value propositions being the entity which is focused on and moved through the process – in science innovation, the generative agency which brings forth new ideas and solutions, and the ownership which confers responsibility to take those ideas forward, is located in specific individual scientists – with scientists themselves being the entity that the system focuses on and moves through the process.

In this final section of the paper we consider the potential for collaboration between ethnographers and human-centered design practitioners, and scientist innovators. In one fundamental respect this might be different to the collaborations forged with technical disciplines and functions within corporations over the past thirty years or more of commercial human-centered design. For unlike engineers, scientists are, in the first instance, researchers seeking to understand how the world works. And in this respect they have a fundamental affinity with social science driven human-centered design, which also seeks first to understand, then to change.

In the course of our research with the scientists who had participated in the i-Teams program, it was striking how many of them located the moment that their vocation in science crystallized in an early experience of observing scientific phenomena under the microscope in a lab. They used the image represented by this experience to articulate the drive they feel to understand how the world works. In practice, how the world works is usually addressed at the level of specific scientific phenomena which become observable, or are made theoretically evident, within the lab – translating into a quest to understand how ‘things’ work. Table 3 draws on our research and the scientist innovator journey outlined in the paper to sketch out a re-framing of the science innovation journey represented in Table 2 (which shows the process at the level of the university and its associated science commercialization ecosystem) to show it from the perspective of what engages and motivates the individual scientist innovator.

**Table 3. Outline for Journey Map of the Scientist’s Innovation Journey**

	How Do Things Work?	What Can They Do?	Where Can That Make a Difference?	How Can I Make That Happen?
‘Cool Science’ Imagination				
Lab-Tech Artisanal Skills				
Embodied Observer/Instrument				
Science Knowledge Community				

The four phase process outlined in Table 3 lays out in simple form the logic which leads scientist innovators from fascination with how things work; to curiosity about what the scientific entities that they have observed or discovered can do in the world; to engagement with where and how that could have positive impact; and finally to embarking upon making that impact a reality. We have mapped these phases against four key dimensions of scientists' dispositions and skills to form the provisional outline of a journey map. It is the fleshing out of this outline journey map through further ethnographic research, and the development of solutions to support the journey of scientists, that we believe represents the most important opportunity for ethnography and human-centered design to engage with science innovation.

Why would we believe that focusing on the scientists, as opposed to focusing on embedding meaningful human problems in the science innovation process itself, is the more important opportunity to support human-centricity in science innovation? This is because we see the current science startup phenomenon as ushering in new possibilities for managing the impact that science-driven innovation has in the world by enabling scientists to remain directly involved in the commercial development and implementation of their solutions. The nature of the scientific platform technologies emerging in the fields of genetics, nano-materials, plant biology, etc. means that the relatively small, focused resources of startup companies – as opposed to large corporations – can be sufficient to bring the technologies to market. The startup company model pioneered by the first genetics-driven biotech startups of the 70's and 80's – science and scientist-led, with strong continuing links back in to academic science, and basing valuation on science IP creation as well as financials (Powell and Sandholtz 2012: 401) – is increasingly viable and available to scientist innovators and entrepreneurs across a range of science disciplines.

What this makes possible is the prospect of different conditions for managing the impact of the agency of scientific technologies in the world. In the mid-twentieth century science innovation model, in which new scientific technology was handed over the wall from university science labs to industry, we might not be surprised if the internal systemic logic – the scientific agency – which is baked into new technologies, once out of the hands of those who created it, results in unintended consequences when deployed in contexts where recognizing and supporting human agency is paramount. The current science-led startup company model offers at least the prospect of a different situation, in which scientists follow the journey of their technology – as in the example of the i-Teams project process outlined in this paper – from its origins as a closed system of scientific agency, through encounters and constructive engagement with other fields of agency as it moves through the commercialization process.

The opportunity that we present in this paper is, therefore, for ethnography and human-centered design practitioners to engage with the human-centered design challenge of supporting the agency of scientist innovators on their journeys from cool science to changing the world, and enhancing their ability to transform the scientific agency embedded in their technologies into solutions which enhance human agency.

**Simon Pulman-Jones**, PhD, is a mentor on the Cambridge i-Teams pre-startup science commercialization program and founder of Emergence Now.

**Amy Weatherup** (formerly Mokady) founded and runs the Cambridge i-Teams pre-startup science commercialization program ([www.iteamsonline.org](http://www.iteamsonline.org)). She is a serial entrepreneur in the mobile phone and embedded software market and is a Non-Executive Director of Audio Analytic whose contextual AI empowers machines with a sense of hearing.

## NOTES

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1. The Cambridge i-Teams approach was derived from MIT i-Teams in 2005-6 with the support of MIT.

2. Development i-Teams is a more condensed program, consisting of 6 sessions over 5 weeks. Development i-Teams was developed in partnership with Dr Lara Allen of the Centre for Global Equality in Cambridge, UK. Medical i-Teams was developed in partnership with the Cambridge Academy of Therapeutic Sciences.

3. Whilst the majority of i-Teams participants are drawn from the science disciplines, there is some involvement from social scientists, particularly on projects relating to health or development.

4. This also allows the participants to start the projects in a way that is strongly within their comfort zone and the scientific culture that they know and understand, before they start to be challenged to move outside that into the commercial world during the program. Often they are already being challenged in this first meeting by working with scientists from very different scientific disciplines who they would not normally have the opportunity to meet.

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## (Fr)agile objects

### Thinking Scrum through Post-It Notes

ISABEL LAFUENTE, *Sidia*  
WILSON PRATA, *Sidia*

*Agile methodologies have taken hold as a model to be followed in software industry. Among them, Scrum is one of the most used frameworks and has a high level of acceptance among a large range of organizations. The underlying premise of Scrum is that by implementing an iterative and incremental process of development, an organization can become more efficient in coping with unpredictability, thus, increasing the chances of delivering business value. In this paper we use the context of SIDLA, an R&D center based in Manaus (Brazil), to look at how Scrum is practiced, by following Post-its notes, which are commonly used in agile landscapes.*

*Following previous work on the idea of thinking through things (instead of thinking about things) as an analytic method to account for the ethnographic experience (Henare, 2006), the purpose here is to draw out the capacity of these objects to re-conceive the workplace. We argue that somehow the extensive use of post-its in this specific context helps to reify the core values of scrum and the agile mindset, at the same time that it shapes much of its practices and discourses.*

*Although we use a specific context as a case-study to articulate the argument, we are less interested in bringing the specifics of the case, than in throwing light on the current perception of agile methodologies as a site of organizational promise, through an object-oriented approach.*

## INTRODUCTION

In the last years, agile systems development methods have been widely adopted in many organizations. At the core of this model lays the premise that organizational agility brings value to companies (Pham, 2012; Barton, 2009), understanding agility as a responsiveness to change. Collaborative and incremental software development started around late 1950 but the term Scrum was popularized after an article by Hirotaka Takeuchi and Ikujiro Nonaka (1986) in the Harvard Business Review. Here the authors compared and demonstrated the advantage of incremental development over sequential development, that is, between agile and waterfall models of development. Later, in 2009, the first version of the Scrum guidelines was published, in which the roles, ceremonies and terms of Scrum were clearly summarized and defined (Schwaber & Sutherland, 2009).

One key notion in Scrum is agility, although -beyond this generic inclination to change and adaptation- the notion of agility remains ambiguous to a large extent (Iivari, 2011). A precise analysis of the concept is presented by Conboy (2009), who defines it as:

“The readiness of an (agile) method to rapidly or inherently create change, proactively or reactively embrace change, and learn from change while contributing to perceived customer value (economy, quality, and simplicity), through its collective components and relationships with its environment”. [Conboy, 2009: 340]

As Iivari argues, it follows from this definition that agility is an emergent property of systems in which a certain method is employed. However, it is not conclusive about the techniques and principles through which this is done, and indeed, it leaves room for different approaches as to how to make agility emerge at the level of the whole method (Iivari, 2011). Another well-known source that tackles this notion is the Agile Manifesto (<http://agilemanifesto.org/principles.html>) which gives a list of features that an agile method should involve, but again, these principles are still very much open to interpretation.

Also, more or less explicitly, the idea of speed lies in agile approaches. Successful agile methods imply not only readiness to change but a rapid and promptly response. In this regard the rhetoric of speed has been extensively appropriated by the field of organizational management, in which time-based strategies are now emphasized as a competitive advantage, and techniques to enhance speed are largely been employed and experimented with among many organizations (Inman, 2010).

In this regard, speed and agility, thus, do not come uncomplicated. A question can be raised about what it is gained and what is missed by adhering to these models. In this work, we problematize the notion of agility, by bringing together a series of ‘vignettes’ that stem from the implementation of Scrum in a specific context. In doing so, we seek to illustrate how the notion of agility is materialized, specifically through the use Post-It notes and, at the same time, how those very things flesh out the specific scope and contours of what agility *can* be.

## THEORETICAL APPROACH

This work draws on different contributions within anthropology which spans actor-network theory, material cultural studies and ontological approaches. The thread opened by Science and Technology Studies (STS), through the so-called "laboratory studies" brought ethnography into the very settings where science is produced through direct observation of the practices and processes along which scientific knowledge is articulated. In this same light, we use ethnography to look at how Scrum is implemented within a particular corporate workplace. To enter our object of study we focus on the materiality of post-it notes, as things that are extensively mobilized throughout the practice of Scrum. By placing these objects at the center of our analysis, we aim to read back from the objects themselves a characterization of the workplace from which such objects emerge. In doing so, we also want to raise a question concerning the rhetoric of speed and movement that usually underlie agile practices.

### Anthropology at Home

Since the 1970s ethnographic studies were strongly incorporated into STS, an approach that redefined science studies around the notion of social construction (Knorr-Cetina, 1983a), as a means to open the *black box* of scientific practices. This approach was then enshrined through the work of authors such as Bruno Latour, Michael Lynch or Steve Woolgar by focusing on the social contexts in which scientific praxis happens. For anthropologists, this involved leaving their traditional field sites and entering contexts in which they were no more exogenous observers. A new kind of “anthropology at home” emerged to deal with subjects whose practices were inserted in the same traditions as those

of the researcher, thus, problematizing the very premises and practices of ethnographic research (Holmes, D. & Marcus, G., 2008). In a similar move, more recently ethnographers have “entered the corporation” under the idea that anthropology too can influence organizations’ understandings, effectiveness and profits (Cefkin, 2010). Urban & Koh (2012) present a comprehensive background of this phenomenon and contextualizes ethnographic practice within corporations, distinguishing between “in-corporation research” -developed by anthropologists generally based on academia but whose object of study is the corporation- and “for-corporation research”, that is, ethnography by employed anthropologists in companies, usually aiming to produce effects or bring about an improvement within the company.

## Things as Concepts

Attempts to enter a territory by way of the objects is certainly not new in anthropology. In the field of material cultural studies, the work of Appadurai (1986) was foundational in exploring the multiple ways in which objects are invested with meaning, function and power. Since then, many others have employed different theoretical strategies to argue in favor of the mutually constitutive nature of the relationship between subjects and the objects they create (Ingold 2000; Miller, 1998).

Taking this project a step further, some authors have begun to use the method of more radically turning to ‘things’ as they present themselves in the field, in an attempt to sidestep the very analytic distinction between concepts and things with which fieldwork is habitually approached (Henare, 2006). According to Marilyn Strathern (1990), modern anthropology has traditionally taken as its task to unveil the social and cultural contexts, as frameworks in relation to which social life is elucidated. Under this approach, things, artifacts and materiality appear as mere illustrators or reflections of meanings which can only be derived from the framework itself. However, the more radical approach these authors employ, questions the enduring premise that meanings and things (their material manifestations) are fundamentally different and tests the limits of such assumption within their own ethnographic material. As a result, by refusing the separation between things and meanings, they turn their focus on how the material itself enunciate meanings (Henare, 2006). This shift in perspective allows to look at the physical environment as if it were another informant in ethnographic practice, for as the material can be now seen as a locus of inquiry in itself (Reichenbach & Wesolkowska, 2008).

Our work sits in line with this approach by following a specific object, that is, Post-It notes, as encountered in our fieldwork, so as to allow them to carve out the terms of their own analysis. As Henare argues (2006) this entails a different mode of analytical disclosure altogether: if things are concepts as much as they are ‘physical’, the question we would like to raise here is: what world -or workplace in our case- does attending to post-its allow us to conceive? -understanding conceive here in the two-fold sense of ‘engendering offspring’ and ‘apprehending mentally’.

In this regard, we use Post-its as a thing that lies at the interface of the material and immaterial. This means not merely that they are material instances of a practice that carry within specific traits of a cultural or social context, as instruments that would, thus, illustrate, cultural characteristics. What we argue is that these things have in themselves a generative

potential, which derives not from its instrumental or cognitive value, but from their distinctive properties as a thing in itself.

## Slowness

Another point we want to raise concerns the rhetoric of speed and mobility that narratives of agility entail. Given the extent to which calls to fast deliverings and rapid cycles of progression lay at the center of agile frameworks, it seems relevant to ask how this practice is informed by the very choice of a specific medium of expression, and also to raise the question of which other possible paths are thus left behind.

Certainly, critiques to this modern inclination towards speed and movement are not new (See, for instance, Andrews, 2008, on the Slow Food Movement; or Hartmut, 2013, a critic of social acceleration under the logic of modernity). Lutz Koepnick (2014) brings several of these manifestations by revisiting the work of various modern artists and intellectuals from a perspective that does not reduce the notion of “slowness” to a mere reverse of “speed.” Instead of this, Koepnick brings new shades and layers of complexity into the work of these authors, that serve to overcome reductionists approaches which simply split the questions into the two poles of modernity = acceleration versus anti modernity = deceleration. Wondering whether slowness can be seen as something else than a banner for deceleration under a nostalgic view of a preindustrial past that does not exist anymore, he pictures it as an opportunity to re-signify the very concept of mobility and growth. From this view, the rhetoric of slowness would not be merely the reverse of acceleration, but this invitation to transform dominant understandings of movement and change. The work of Amazonian author Paes Loureiro (2015) offers an interesting counterpoint to the notions of progress and advancement that lie at the normative center of these rhetoric. The poetic attitude, which he defines as an essential feature of Amazonian identity, brings forth a notion of temporality and movement that move away from the sense of direction, speed and progress characteristic of modernity. His is a notion of time measured in intensity rather than velocity and a notion of space that is flesh out with intermingled narratives, visions and temporalities.

Based on the argument that the material bases of any practice inform its process of meaning-making, we suggest that the untapping of the possibilities that Post-it notes give rise to can also reveal which other modes of thinking, knowing and doing remained untried.

The remaining of this paper gives an overview of common practices within the Scrum framework and then offers an assemblage of images taken during fieldwork accompanied by a short descriptive sketch, aimed to bring to the front some aspects of the sort of epistemic culture that agile involves. Both the pictures and the vignettes are based on in-corporation anthropological research carried out at SIDIA, a Research and Development Institute located in Manaus, Brazil, during the first quarter of 2019.

Through this approach we aim to depict Scrum as a cluster of things, literally affecting and being affected between them, with Post-its being at the center of it. Instead of trying to answer the question of ‘what these things are’, we ask ‘what it is that Post-its make (us and others) do’.

## Things in Scrum

It all starts with a text, a document that lists all the features of the software in order of priority. This document is called the backlog. The backlog is solved in short cycles of development called Sprints. One sprint follows another, at the end of each one there is a deliverable, a small piece of software that correspond to some stories of the backlog. Each story is composed by description, acceptance criteria and ratings. Description is what should be delivered by the team, acceptance criteria is what defines that the story is done and the rating is an abstraction of the effort it takes to achieve that story. The points are scaled in a semi Fibonacci sequence (0, 1, 2, 3, 5, 8, 13, 20, 40, 100), the logic is that 1 or 2 represent the story requiring less effort and the others are graduated using this as a reference (if it is two times more demanding, it has a score of 5 and so on). There are three roles in Scrum: product owner, scrum master and development team. Product owner writes the backlog and evaluates if the team has delivered the stories accordingly, development team works to implement the stories, i.e., develop the features of the software, and scrum master mediates the relation between the product owner and the team, as well as makes sure that there are no impediments for the team to work properly.

Scrum is articulated around different events, which are called "ceremonies" that bring structure to sprints, that is, to each of the incremental phases in which a specific project is divided. As any ceremony, these events are key to understanding the culture and the values that Scrum emphasize. These are: planning, daily, review and retrospective. Both sprints and ceremonies are aimed at "speeding up" the development process, by setting up the goals for success throughout the project. Thus, agile methodologies are aimed at producing scenarios of agile development (Sabbagh, 2014).

Under this frame, the artifactual character of the process is rendered preeminent. During ceremonies, teams come together around a number of objects, such as cards, Post-Its, slides and white boards to share their work-in-progress and set the next steps for the project. These objects are objects to mediate interactions: intended for transitory inscriptions, reifying ongoing work and repositionable information. At the same time they introduce a particular topology because they involve an opening up of a space which summons a particular arrangement of things and people.

Among the common infrastructure and spatial lay-out of these environments, post-its, boards and paper cards visibly stand at the center of the work space, acting as "placeholders" around which teams gather and organize themselves. The rapid and iterative articulation of a specific project around sprints and ceremonies, strongly fosters the making and visual deployment of this kind of artifacts. They are oriented towards a deliberate organizational effect, for they are indeed mobilized to speed up change and iteration. In this regard, it is no accident that they become ubiquitous within almost any organization where agile frameworks are in play.



Figure 1. Photograph ©Juan Orestes, used with permission.

Here we focus on Post-it notes, which acquire a central role in these scenarios. Post-its in Scrum are objects used to think *with*, to the extent that they serve to express ideas at the same time that they shape them. By way of them tasks, doubts, activities and certainties become registered; at the same time, those 'drops of thinking' are determined and by the physical characteristics of Post-its. While interacting with them, it is unavoidable to fall on a series of premises, as for instance, the need to be clear and to do one thing at a time, or the convenience of using the verb-noun structure and technical terms, to mention some.

Also, during Scrum sessions, Posts-its are moved from one column to another, making visible the progress that has been made. In this regard, they somehow materialize the speed with which the project advances, in terms of which the efficiency of the team is measured. They provide transparency to the project, by making visible on the wall what the team has committed to delivering and what everyone is doing. All these aspects, which are directly related to the properties of these things as things, fashion a certain kind of object and social relations, and ultimately engender a specific culture of knowing.

In the next section, we look specifically into three aspects that were rendered visible through our fieldwork: their transient nature, the succinctness they convey, and the mosaic character of the output and display.

## VIGNETTE 1: TRANSIENT THINGS

Daily meetings are a central ceremony for team alignment within Scrum. These are short, 15-minute-meetings, usually done on a daily basis, aimed to prioritize and divide tasks, determine the progress of the project and identify impediments. Usually the core of the meetings can be summarized in two questions: what have you worked on since the last daily meeting and what will you work on until the next one. It is also an occasion to identify and share if there are any impediments hindering your work. Usually these meetings are held in a predetermined place and it is common to do them standing up to keep up the 15-minute format.

At SIDIA daily meetings are held around a wallboard that presents the different goals that have been assigned for the scrum team at the beginning of the sprint (called 'stories' in Scrum terminology) within a table that includes several fields designating the incremental stages of completion. Within agile methodologies, the use of boards as a working tool are quite common. In the case of Scrum, usually this board comes with four columns: stories, to do, in progress and done. The stories contain the description of the feature that should be implemented until the end of the sprint, a sprint runs with one or more stories; to do refers to the tasks that need to be done so that stories can be considered completed; in progress list the tasks that are currently under development; when they are finished they are moved to done. At the side of the board there is the burndown chart which indicates the pace at which the stories are being concluded. The burndown chart shows the progress of the sprint in a two axis cartesian plan: time represented in days versus effort represented as stories' points. It indicates if the sprint has succeeded (if in the end of that cycle all stories are completed) or failed (if at least one of the stories can't be completed). The tasks are chosen or moved from one column to another during the dailys, a meeting that occurs everyday around the board. These fields work as checkboxes for each of the stories. During the daily meetings, the checkboxes are filled with post-its notes describing shortly (maximum two or three words) the specific tasks which are being addressed and the progress made so far.

As a whole the board serves as a visual indicator of work progress. It is implicitly assumed that post-it should advance from the initial columns , to the final ones as the sprint goes on and, thus, it works as an early-warning mechanism that allows to rapidly detect hindrances in the overall time framework of a sprint. During these sessions no one actually *reads* the post-its -for indeed they are not really intended for that. Post-its are not used as content markers but as progress markers; or put in different words, it is their mobility through the board -and not what they 'say'- what matters most.





Figure 2. Photograph ©Juan Orestes, used with permission.



Figure 3. Photograph ©Juan Orestes, used with permission.

## VIGNETTE 2: SUCCINCTNESS

The practice of using post-it notes and sticking them on the walls of the workplace during Scrum ceremonies is very common within SIDIA and it is strongly related to principles of agility.

However, the requirement of fitting every task into the size of a Post-it note is not trivial, especially for beginners and people who do not have a background in design cultures, where the use of this type of elements is much more frequent. Shortening a text to the point of making it fit into the Post-it involves an exercise of succinctness that requires certain practice. At the same time, such succinctness of content directly influences the sort of effects they summon. Just as words within the paper have to be drawn up tightly -and there is no room for long-winded sentences, syntactic complexities or conceptual nuances- the interactions they tend to produce are also marked by brevity and conciseness. Also as with words, daily meetings are compressed into a small area, both in terms of duration and spatial display.



Figure 4. Photograph ©Juan Orestes, used with permission.

This effort of succinctness has a side effect in that it defines what sort of things are discussed and which are left unspoken. Since Scrum framework has a strong and rigid time pace, one sprint following other, usually there are few spots for reflection, questions and research about "why" something needs to be done. Scrum is a framework designed to get things done, sometimes at the expense of preventing any problematization of the project and its vision. The "post-it length tasks" shapes the behaviour of the development team as a challenge-oriented way of thinking since post-its are good to represent challenges that need to be completed, usually from one day to another, which is the time frame between dailys.

Also, the Agile Manifesto and the principles behind it, emphasize collaboration as a central element of Scrum. But the sort of collaboration that is involved in practice does not necessarily extend beyond the particular tasks that need to be accomplished during a sprint to the deeper layers of project value and purpose. In this regard, post-its generally afford more of an immediate, short-term and practical type of collaboration. They operate as an interface that mediate fast exchanges, which do not demand from team members to invest themselves in larger questions or concerns regarding the project.

### **VIGNETTE 3: MOSAIC**

Retrospective meetings are part of Scrum periodic ceremonies. They are held by the team and are conceived as an opportunity to look back in order to identify strength points and possible improvements to the work process as a whole. It is the only meeting which does not focus on the product, but on the process itself. At SIDIA these meetings are held after each sprint. The format they follow is rather informal aimed at creating a friendly atmosphere where teammates can speak more openly about questions regarding work, beyond the particular tasks they have been involved in. Also here Post-its play a significant role. Again using a wall, each of the colleagues write down in a brief manner both positive and negative things that they want to share with the group (one post-it per input) and stick the note onto the wall so that it is visible for everyone. A brief explanation is given and the next colleague does the same, until all the questions are hanging in front of us. Team members use that opportunity to share their thoughts and difficulties. No name is linked to the post-its, so at the end of the session the notes on the wall represent a collection of ideas, indeed, a collective picture detached from individual authorship. What matters, indeed, is the output as a collection and not the individual register of who-said-what.

This unfolds a particular approach to the notions of ideas and concepts. At the moment when ideas are sketched out under a word or two within the post-it note, it makes it count as a concept within the group, a process that happens between an interiorized thought and the exteriorized object hanging on the wall, involving a sort of material liminality (Gunn, W., 2013).

The sort of concepts thus created are not individual, but collective; post-its serve as transitional objects to turn heterogeneous inputs into similar and homogeneous material that can be physically handled. In this regard, these objects can be considered as "split entities" (Latour and Woolgar 1986 [1979]), whose main significance is not to represent individual input, but that constitute a material collection, with a value on their own. In fact, post-its work here as way of depersonalizing an object from a subject, that is, an objective reification

of a subjective perception: as soon as an individual feeling or thought is written down, it is not a feeling or a thought anymore, but an objective information that can be shared with the team and registered in the project history.



Figure 5. Photograph ©Juan Orestes, used with permission.

## DISCUSSION

These examples of Post-Its in practice alluded to so far reveal how the properties of Post-its as things inform the Scrum practice both physically and conceptually. We make the point that within Scrum culture, Post-Its notes can be taken as a generative concept, that is, as a thing that lies at the interface of the material and immaterial with a generative potential derived from its distinctive properties. In this regard, they can be considered as a key element of agile arrangements around innovation. It can be argued that "post-ity" ways of thinking and interacting are competencies sought under Scrum frameworks as a style of agile production and practical intervention with specific traits. In this work, we have focused on three:

First of all, working on and around Post-Its involves a compulsion towards progress. Vignette 1 illustrates the extent to which emphasis is put on work in progress and the processual character of iterations. Through the act of sticking post-its on the wall and moving them along the table as the sprint advances, they are transformed into a proxy for movement and progress rather than instances of knowledge.

The above is closely related to the succinctness both of the object and social relations that are enacted through them. By the continual exteriorizing of concepts in nugget-sized forms, post-it notes turn into pieces that can be worked on by teams with brevity and conciseness. These pieces have a somehow "slippery" nature giving shape to a shifting constellation of relations that are continually in flux.

Finally, the mosaic display that results from Post-its usage is also preeminent within Scrum practices. As material manifestations visible to everyone, they turn from interiorized ideas to materialized concepts that are now collective things which enter into a process of juxtapositions and montage. This gives way to a mosaic way of thinking, that places the emphasis on relational and collective thinking, rather than in individual outputs. This sort of micro-transformation from ideas to information that is fit-for-working and fit-to-be-seen represents the kind of process to which abstract notions, ideas or concepts are subjected under Scrum. The very materiality of post-its enable specific ways to set and to consolidate knowledge around a project, understood as the product of groups, as opposed to individual minds.

### **(Fr)agility**

These traits set the conditions for a cultural practice with very specific characteristics. However, to the same extent, they also define the field of possibilities that remain outside of these contours. The question now is what is thus cut off from the "post-ity" way of knowing.

The high adherence of the digital industry for agile approaches reinforces a specific reason, the "proleptic reason", which Boaventura defines as a way of thinking that understands the future as a linear, automatic and infinite continuation of the present. Under this reconfiguration of time and space lies, implicitly, a notion of progress along a single temporality in which the emphasis is placed on becoming rather than on being. Thus, since the progress is linear, the question is not about where are we going but how fast can we get there (Souza Santos, 2002). Being the first to release a new technology, a new feature or a new service is the key point for success within this particular mindset. In the same way, short cycles of planning, development and release, in opposition to detailed planning, and mass production and distribution, can be understood as an extreme compression of space and time, a phenomenon that according to Harvey characterizes modern capitalism. The acceleration in the rhythm of production and consumption cycles has been gained at the expense of space, or rather, upon the presumption that spatial variables -those related to social structures, power relations or affects- can be suppressed (Harvey, 1992). This flattening of space under a notion of temporality understood as a single directional vector leads to an illusion of control. In this regard, Han argues that this modern notion of temporality is contingent upon control metrics that seek to assign always quantifiable values and establish casual relations along a chain of elements. When actions are subordinated to a process of calculation, governance and control they become transparent, thus, operational (Han, 2015b). If this serves to stabilize and speed up the system, it also erases otherness and difference.

According to the author, one of the realms in which this becomes more noticeable is language. In order to remove its intrinsic ambiguity, modern organizations rely on a type of language which is as formal and efficient as possible, in order to turn it operational. A

retrospective in which all the feelings and thoughts need to be shaped to fill in a single post-it guarantees that otherness, doubtiness and difference will be highly minimized. Thus, the search for transparency leads to a systematization both of language and social interactions to avoid any frictions that might naturally arise from moments of forgetfulness, discontinuity, doubts or intuition. Moments of reflection and theoretical thinking give way to technique because theory in itself constitutes a negative substrate of things, that is, a result of an operation that goes against what is given, thus, separating the continuum and revealing hidden relationships between variables and objects (Han, 2015b).

As said before, Scrum is a framework to get things done, it doesn't lead well with research, reflection or theorization, in fact, there is no room (in any ceremony or during the sprints) to do so. In this regard the succinctness expected under agile landscapes -both in language and in social interactions- can be seen as an erasure of negativity, in the sense that Han uses the notion, that is, as a way of fencing off practices of production and development.

But what happens, for instance, when more thoughtful and slower responses are needed in moments of uncertainty as they unfold into the Scrum process? Although it is beyond the scope of this work to explore the multiple unfoldings of this question, we would like to set forth some ideas of what such a possible diversion or slowing down could look like.

### **Ethnography as *Devaneio***

Differently from a perspective that conceives movement as a shift from one point to another, or an advancement along a temporal vector marked by a direction, movement can be seen as a field of intensities, that is, as a practice of immersion, of absorbing, of engaging deeply in the present moment.

The Amazonian author Paes Loureiro (2015), in his analysis of what constitutes amazonians' identity offers an interesting approach for re-framing the notion of movement and, in particular, what it means to look at processes of slowing down not as a delay in happening but as a way of intensifying and enriching the present.

At the risk of gross simplification, if during modernity time was conceived primarily as a vector of movement, change and progress, in contrast to space which was the fixed, the static, that which remains, in Paes Loureiro's work space becomes prominent. Through a "poetic way of thinking" -which he defines as an attitude that is essential to the identity of the native and it is evidenced by "a wonder at everyday reality" (Loureiro, 2015: 121)- space itself becomes the locus of mobility, while time is no longer a directional vector but an intensional one. Thus, the concept of *devaneio* (Portuguese word, literally meaning daydreaming) becomes central, which he defines as a vague and contemplative attitude associated with simple being, pleasure and presence in the face of reality. Put it differently, a sort of receptivity to the environment, almost a reaction of the self through the senses propitiated by the Amazonian landscape itself and the relationship that the native maintains with it.

In this regard, *devaneio* is movement; a movement which is defined not by the displacements it brings, but by the intensities that traverse through it. To the extent that it is a way of expanding the present, *devaneio* involves slowness and permanence because the present takes place primarily in space, in the here and now; It is, though, an enriched space,



no longer the simple fixed and static container where things happen, but the soil where different possibilities, intensities, narratives and visions coexist and intersect.

The way that Loureiro understands the relation between time and space is clearly opposed to the way that modernity approach these instances. According to Harvey (1992), considering the way of production and the dynamics of capital since the end of last century, time was used, first, to take hold of space, and then to liquidate it. Agile practices solved a problem of the old paradigm of production, which was born in large scale factories. This paradigm was strongly dependent upon questions of space (such as logistic, distribution, time as an input for physical production, to mention some), and it became outdated and incapable of handling the dynamic of continuous change and technical improvement that software development demanded. To address these challenges, agile practices were introduced and gained legitimacy in the software industry, although at the expense of causing the "super valuation" of time over space.

So the question we would like to raise is this: how can the concept of *devaneio* be re-signified in the context of current rhetoric on agility and innovation that have taken hold in a large number of institutions and organizations? Rather than answering this question, here we set the scene for further thought and discussion.

First, a claim for slowness within organizations should move away from a notion of slowness which conflates it with deceleration. In this sense, a culture of slow innovation would not be the opposite of acceleration and advancement but an enrichment of the present experiences; to slow down is to intensify the present not necessarily to reduce speed.

Second, to the extent that, in this sense, slowing down involves an enrichment of the present's experiential and conceptual density, we need to design mechanisms that allow for *devaneios* and processes of record, tracing-out and immersion, that can coexist with those of production and development.

It is important to highlight that the notion of *devaneio* implies a non-objective relation between time and space. It still logic, but the axioms of this logic are grounded on a relation constructed between the self and the place. Instead of time ruling over space, it's the space that determines time, that is, the pace of time is shaped by the self within the place.

A claim for slowness, or a claim to regain an enriched present, will lead us to rethink our relation with space. Although at first it might look as a question of time, it is in fact a concern around space, around seeking forms of landing and re-encountering ways of belonging; like the notions of ancestry, legacy and heritage, we would, thus, need to make sense of time and temporality considering questions of space, the others and the collective.

Finally, as anthropologists working within corporations, we can ask how this approach to innovation culture in organizations can benefit from ethnographic skills and practice. Similar to the way that Paes Loureiro defines the Amazonian poetic attitude, the anthropologists typically immerse themselves in their subjects of study. Likewise, the ability to transit across registers, narratives and perspectives within a "multifaceted present" can certainly be considered a cornerstone of ethnographic practice.

Within anthropology, the figure of the researcher doing fieldwork has always been closely tied to the rhetoric of engagement and commitment to their subjects of study and their experiences in the field. There is almost a sort of ethical code embedded in anthropology which measures the work of an ethnographer to the extent that he is capable of entering in a flow of affections -of taking and being taken by- among the people studied and turning that experience into the fuel of purpose and action. That which distinguishes

ethnography from other research techniques has to do with the ability of entering in a circuit of connections immanent to fieldwork itself, that brings about a change for both parts. In this regard, when anthropologists are urged towards autonomy, in practice this has more to do with the demand of being true to the rapport of forces in which they find themselves enmeshed during fieldwork, than with the need to remain independent and separated from any influence. So, at the core of an anthropologist's skills there is this capacity to affect and be affected, based on the acknowledgment that theory is never a value-free zone and that transparency cannot ever hover above embodied lived experience.

So we can ask how this understanding of autonomy and transparency based on ethnographic practice, which is marked not by disentanglement, but by skills strongly rooted in experience, can be re-signify in the context of innovation culture. From this view, the sort of mechanisms we might be willing to search for are not the ones that remove "negativity" from life and interactions but those that encourage processes of immersion within the subject of study, enriched interactions among the actors involved and ways of letting oneself be affected by those; in short, mechanisms that multiply and strengthen the articulations between beings and things.

## CONCLUSION

Our aim has been to illustrate how agility is materialized through the use of post-it notes and how these flesh out agile practices along specific traits which derived from the thing's properties.

In this regard, post-its can be regarded as a key element of agile practices among many organizations. Even in contexts where physical post-its are being replaced with technologies that allow to plan, manage and monitor Scrum practices digitally, it can still be argued that "post-ity" ways of thinking and interacting are competencies sought under agile organizational frameworks, which define forms of knowing and doing things with very specific traits. At the same time, we have made the argument that these things also set the field of possibilities that remain outside of the world they help conceive.

In asking what it is they do and do not afford, we discussed how the notion of slowness can be re-signified to go beyond simplistic divisions between acceleration and deceleration in the context of current rhetoric on agility and innovation. To so so, we considered an amazonian approach, as developed by Loureiro, in which slowness is seen as a way of intensifying the present; thus, it offers a counterpoint to the modern notions of progress and advancement. Finally, we raise the question of what sort of mechanisms would allow this to happen and ended up with a brief insight into how anthropology and ethnographic practice can be enlisted for this purpose.

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## Hybrid Methodology

### Combining Ethnography, Cognitive Science, and Machine Learning to Inform the Development of Context-Aware Personal Computing and Assistive Technology

MARIA CURY\*, *ReD Associates*  
ERYN WHITWORTH\*, *Facebook Reality Labs*  
SEBASTIAN BARFORT, *ReD Associates*  
SÉRÉNA BOCHEREAU, *Facebook Reality Labs*  
JONATHAN BROWDER, *Facebook Reality Labs*  
TANYA R. JONKER, *Facebook Reality Labs*  
KAHYUN SOPHIE KIM, *Facebook Reality Labs*  
MIKKEL KRENCHER, *ReD Associates*  
MORGAN RAMSEY-ELLIOT, *ReD Associates*  
FRIEDERIKE SCHÜÜR, *Cityblock Health*  
DAVID ZAX, *ReD Associates*  
JOANNA ZHANG, *ReD Associates*

\* Denotes co-first authors.

*The not-too-distant future may bring more ubiquitous personal computing technologies seamlessly integrated into people's lives, with the potential to augment reality and support human cognition. For such technology to be truly assistive to people, it must be context-aware. Human experience of context is complex, and so the early development of this technology benefits from a collaborative and interdisciplinary approach to research—what the authors call “hybrid methodology”—that combines (and challenges) the frameworks, approaches, and methods of machine learning, cognitive science, and anthropology. Hybrid methodology suggests new value ethnography can offer, but also new ways ethnographers should adapt their methodologies, deliverables, and ways of collaborating for impact in this space. This paper outlines a few of the data collection and analysis approaches emerging from hybrid methodology, and learnings about impact and team collaboration, that could be useful for applied ethnographers working on interdisciplinary projects and/or involved in the development of ubiquitous assistive technologies.*

#### INTRODUCTION: THE POSSIBILITIES OF ASSISTIVE TECHNOLOGY, THE COMPLEXITIES OF CONTEXT, AND THE NEED FOR A HYBRID METHODOLOGY

Technology has altered everyday experience. People carry smartphones in pockets or purses and smart watches around their wrists. From light bulbs to air conditioners, today's homes are smart. Given the rate of change we have witnessed over the last decade or so, we can easily imagine a not-too-distant future that brings more ubiquitous personal computing technology seamlessly integrated in people's lives with the potential to assist people in everyday tasks. What may people want of such devices and how might we design assistive technology to give people what they want and need?

We can imagine well-timed pieces of information, a person's name, for example, discreetly delivered to avoid awkward encounters. We can imagine interventions that fit the

needs of individuals in the moment, lowering the volume of background music to boost concentration. We can imagine that the playlist might be selected based on current mood or current goals. These examples highlight how interventions might be further personalized to depend on the person and the person's context. For example, one individual cooking a meal may be an aspiring chef who wants to focus on improving cooking skills and may welcome instruction and feedback, whereas another person may dislike cooking and may welcome some background music or an interesting podcast to distract from the cooking chore. Furthermore, we can imagine that it may be just as important to know when *not* to intervene, such as during a moment of deep conversation and true connection between people. In short, individuals in situations that may look alike can have very different needs. How might a device learn to understand a user and parse a user's situation, or context, to make decisions about *whether*, *when*, and *how* to provide assistance? How can such devices be designed to provide information or interventions that fit the needs of individuals in-the-moment and support how they wish to act upon their world?

At the outset of our research, we asked ourselves how we might be able to study the ways people experience complex yet everyday contexts to bring into focus the promise of future assistive technology *and* how to build it. We wanted to inform (at a very early stage) both the value such devices could offer to people in-the-moment and also how these devices might be built to parse context. In the process, we discovered the need for collaboration across disciplines and the need for a *hybrid methodology* that combines frameworks and concepts across disciplines. A single discipline's tools and approaches are likely too narrowly scoped to this new and large problem space. It requires an exploratory approach (where ethnography brings strength), combined with a focused study of internal states (where cognitive science brings strength), and it needs to be ultimately relevant to machine learning, requiring that analysis methods be informed by the types of data and data representations that machine learning will consume.

In our work, we thus drew from the disciplines of cognitive science, anthropology, and machine learning.

Cognitive science, broadly speaking, aims to characterize the nature of human perception, thought, and decision-making. Cognitive science provides methods that help us gain insight into the feats and limits of human information processing. Devices can display or otherwise share a great amount of information, and cognitive science provides the methods to understand what can and cannot be meaningfully processed by human cognition. Insights are most often gained through carefully controlled experiments in a laboratory or in a specific activity (e.g. air traffic control, Christensen et al. 2012).

Anthropology is the study of human societies, cultures, and their development and it provides us with methods that help study individuals in context. Anthropologists study and derive meaning from the everyday — observing how a range of sociocultural forces, structures, and relationships interact to form a person's experience of the world, and how that person, in turn, acts upon the world in ways that push against, reinforce, or reshape those forces. Anthropologists are experts of context, abstracting out from “thick descriptions” (Geertz 1973) of individuals to make broader reflections about human experience.

Machine learning is the study and application of algorithms and statistical models. To deliver in-moment solutions, assistive personal computing devices will need to be powered by machine learning algorithms that learn from sensor data. The challenge is that these

devices need highly scalable solutions that at the same time offer strongly tailored experiences specific to individuals in context. This requires a framework that allows algorithms to abstract away from particular experiences of individuals to uncover what may be shared across individuals and situations.

Borrowing concepts or methods from all three disciplines helped us develop a more robust understanding of individuals and their contexts in ways that can support the early development of new forms of personal computing and assistive technology.

We hope hybrid methodology serves as a call for applied ethnographers to adapt their methods, deliverables, and ways of collaborating for greater impact in this space. Traditionally, qualitative data and user research are used early in the product development life-cycle to identify and scope use cases for the product and then late in the product development life cycle to gather user feedback on prototypes, finished products, and product features. Qualitative data rarely informs machine learning problem formulations or cognitive science experiments. We go beyond this traditional model toward deeper collaboration. Ethnography is no stranger to hybrid approaches — for example, anderson et al. (2009) have explored the combination of qualitative research with data mining into “ethno-mining [...] a hybrid, not a ‘mixed method’; it is two elements that cannot be separated out [...] [yet] traces of each of the ingredients can still be seen - the same ethos of ethnography (open-ended, co-constructed, holistic field research) integrated with the empirical and analytical capacities of quantitative data mining“ (anderson et al. 2009, 125). Applied social scientists have also been exploring the blending of “big data“ with “thick data“ (Bornakke and Due 2018) and outlining approaches like “Contextual Analytics: a project process for uniting data analysts and social scientists under the mandate of building more effective and credible algorithms“ (Arora et al. 2018, 225). Our work hopes to carry this thinking forward.

In this paper, we outline our approach to the early development of assistive technology. In the process, we share how our hybrid methodology allows us to answer novel research questions and how it supports the development of new products. We doubt that we would have been able to achieve these results had we not all stepped beyond the comfort of our disciplines, finding ourselves in a collaborative balancing act: considering tradeoffs between the practices of one discipline and another, between the structure of the lab and the openness of the field, and between the different definitions of what data is, how it can be analyzed and processed. This paper outlines a few of the data collection and analysis approaches emerging from hybrid methodology, and learnings about impact and team collaboration that are useful for applied ethnographers working on interdisciplinary projects, particularly those involved in the development of ubiquitous assistive technologies.

## **SITUATING HYBRID METHODOLOGY: ABOUT OUR STUDY**

An interdisciplinary team combining Facebook Reality Labs and ReD Associates researchers with expertise in anthropology, cognitive science, and machine learning sought to understand the human experience of performing tasks in everyday contexts, to inform the early development of context-aware assistive personal computing technology. We studied *experience*, or the subjective moment-to-moment internal states of our participants, with a particular focus on the experience of mental effort. And we studied *context* itself.

It is our belief that by taking the broadest possible view of context, we can build ubiquitous devices that are truly useful partners to people, enhancing their agency through a

smart and sensitive parsing of the fullness of their experience. Linguistic anthropologists Alessandro Duranti and Charles Goodwin define context as “the frame that surrounds an event and provides resources for its appropriate interpretation” (Duranti and Goodwin 1992, 3). Context in its broadest sense includes not just spatial context (a physical environment), but also layers of social context, personal/psychological context, and temporal context. In order to study contexts in-situ, we began by de-constructing a context into its component parts for observation. Our categories were similar to those used in Activity Theory, a framework from the social sciences which acknowledges how the physical environment, social dynamics, cultural norms, objects, and the individual mind are interconnected in an activity (Engeström et al. 1999; Kaptelinin and Nardi 2006; Nardi 1996; Roth 2004).

We wanted to ensure we were attuned to the different elements of a context while in the field (and how those elements interacted), and careful not to collapse context to the sum of its parts in-the-moment, so our field guide included prompts to systematically observe each component we defined. We used a range of theories to shape our understanding of the different components of context, mixing theories in perhaps ‘low fidelity’ or bricolage ways that focused on drawing out and combining the aspects of each theory most helpful to our research question (Cury and Bird 2016). For example, we brought theories about the built environment’s impact on human experience (Goldhagen 2017) in conversation with findings on the physical environment’s impact on mental effort (Choi et al. 2014) and with theories about how the passage of time can be perceived through distinct spaces and tasks (Ingold 1993). We considered how people’s movements and ways of seeing are socially constructed and learned (Mauss 2009; Grasseni 2007), together with findings on the effects of visual training on how people make observations (Braverman 2011). All of these together helped us to build a multidisciplinary understanding of context to explore in the field.

We met with eighteen participants from Seattle, New Jersey and New York — eight females and ten males, ages ranging from 25 to 54, with diversity in ethnicity, occupations, home types (e.g. apartment, house), and living arrangements (e.g. single living alone, roommates, couple without kids, couple or single parent with kids). The researchers disclosed the identity of the organizations conducting the research and the high-level aims of the research to each participant prior to the participant’s voluntary consent to join the study. Participants were compensated for their involvement, were informed that they could withdraw from the study at any point, and were given opportunities to ask questions about the study and its methods.

Two researchers met with participants for a full day session in their homes and communities, accompanying them during their daily routines. Drawing from the sensory ethnography guidelines of anthropologist Sarah Pink (2009), researchers conducted participant observation in which they were attuned to their own sensorial experience of the spaces they were in with participants, and in which they asked participants to reflect on both the abstract and sensorial aspects of the activities they were doing and the objects they were using. Researchers conducted semi-structured interviews about participants’ home life and personal history, and various exercises to map what tends to occupy their “headspace” on a given day, their relationship to technology, and their social ecology. The research centered on systematic observation of two focal activities, followed by in-depth discussion with the participant after each activity. For the focal activities, all participants cooked a meal in their kitchen and performed a second goal-oriented activity of their choosing (e.g. doing laundry),

mostly in their homes. We strove for variability in how participants generally felt about the two activities based on self-reporting ahead of time along key factors such as whether they found the activity enjoyable.

Prior to the activities, participants completed a training session to understand the concept of mental effort (from the field guide: “*The amount of mental activity that is required while you're doing some task or tasks. This mental activity can involve thinking, deciding, calculating, remembering, searching, etc.*”). They were provided with a definition and analogies, a numerical scale to use during the activities, and a series of exercises to practice reflecting on mental effort and ensure comprehension of the concept. During both activities, participants were recorded using a wide-angle camera to capture the physical context of the activity. In the cooking activity, participants also wore a head-mounted camera that captured the activity and context from a first-person perspective. During the two activities, one researcher recorded ethnographic field notes, while the other probed the participant to report their mental effort periodically and systematically. The visual recordings as well as the self-reports were used during the de-briefing discussions with the participants.

We captured a variety of qualitative and quantitative data, including thick ethnographic field notes, descriptive mental models and maps (e.g. of “headspace,” technology use, social ecology) drawn together with the participants, repeated numeric mental effort scores with verbal descriptions of contributing factors, and high-resolution video data of a participant’s context and first-person perspective. We analyzed these data in a similarly varied way upon return from the field, drawing on approaches from the researchers’ “home disciplines.” It is from these data and analyses that we generated insights, abstractions, and data labelling protocols for parsing context, that have now advanced into the work of machine learning and cognitive science teams (see Jonker et al. in review, for selected findings).

This project — with its ambition to understand human experience of context for technology development — required a constant dialogue across disciplines that study dimensions of experience and context. The project required combining methods, frameworks, concepts and ultimately data from anthropology, cognitive science, and machine learning (alongside philosophy, linguistics, and journalism). It also required applied ethnographers to push the boundaries of what constitutes data, an insight, and an output of research, to be relevant. What follows is an outline of a hybrid methodology that may guide interdisciplinary teams to better collaborate, and for ethnographers to find new applications of their work.

## **HYBRID METHODOLOGY RESEARCH: DEVELOPING RESEARCH METHODS**

Interdisciplinary projects have an interdependence of methodologies, and each method gets a little bit “sullied” as it moves out of its intended disciplinary realm and into a hybrid space. For instance, when ethnography moves to the semi-structured environment of the participant’s kitchen that is now set up with conspicuous cameras and two researchers (one of whom is asking scale-of-one-to-nine questions systematically every three to five minutes), “pure” participant-observation is, arguably, not happening. If the represented disciplines’ experts each feel slightly uncomfortable with the imperfection (or slight irreverence) with which their methodologies are being deployed, the team may actually be in a good place. The

emphasis is on triangulation and testing, with the ultimate deciding factor for choosing and melding together methods being: what is most in service of answering the research question?

What follows are two research methods, drawn from our study, that combine approaches from different disciplines to help answer the research question “how do humans experience everyday activities in daily contexts?” to inform the development of new personal computing and assistive technology. For researchers with similar research questions, the two methods described here may be directly relevant. For researchers with different research questions but a similar interdisciplinary team set-up, the methods described here may serve as an example for how other methods, from other disciplines, may be hybridized to suit the needs of the research question.

The first method we describe, experience sampling in participant-observation, combines an approach from social psychology with ethnographic research, to gather data on the experience of context in-real-time. The second method we describe, reconstructed narratives with video playback, involves the active role of the research participant in reflecting on their experiences using video footage, to gather data on internal states that would otherwise not be gleaned from researcher observation alone.

## **Experience Sampling in Participant Observation**

How do researchers capture a person’s momentary experience in a way that lends itself to systematic, multi-disciplinary analysis? First, measurements should be captured in-the-moment, to give us access to the often-transient experience during a task, and to avoid biases in retrospective recall (Redelmeier and Kahneman 1996). Second, the protocol itself has to be relatively non-intrusive, to not affect the person’s experience in the moment. And third, the measurements should be simple, to avoid selection bias and ensure meaningful responses from all participants.

One approach for doing this is experience sampling (or event sampling), a widely used method in social psychology (e.g. Reis and Gable 2000; Larson and Csikszentmihalyi 2014) and cognitive science (e.g. Kane et al. 2014; Killingsworth and Gilbert 2010) to consistently elicit subjective thoughts, feelings, and behaviors in the moment. For example, a researcher studying adherence to a new health habit might have research participants install an app on their phones that pings a prompt to them twice a day, asking for a reflection about how tired they are feeling or about whether they completed a routine. Experience sampling allows researchers to capture a representation of experience as it occurs, and to analyze patterns and relationships as they unfold over time. The repeated measurements are collected in different contexts and during various tasks and sub-tasks, enabling researchers to unpack and disentangle the complex contextual factors affecting subjective experience. Because experiences are captured in the moment, rather than after-the-fact, participants are less likely to suffer from memory bias. In retrospect, people tend to overestimate the difficulty of certain tasks and the amount of energy applied to solving these (Schmeck et al. 2015). Furthermore, experience sampling is a validated tool that enables researchers to compare results across study sites (such as a lab versus a naturalistic environment).

Compared to laboratory experiments, experience sampling methods have the advantage of collecting data in the participant’s everyday contexts. This allows researchers to observe thoughts and feelings as they occur during everyday activities that can be difficult to recreate in more controlled settings. Indeed, in a study of mind wandering, researchers discovered



significantly higher frequency of mind wandering in daily life than is typically seen among participants in laboratory experiments (Killingsworth and Gilbert 2010). Further, it allows researchers to understand not only how participants experience certain tasks, but also how much mental energy they invest in the task — an aspect that is crucial to development of assistive technology, as described in the introduction.

However, experience sampling methods place heavy demands on researchers and participants alike, and as we found, require careful instruction to ensure that all participants are comfortable reporting their answers. When conducting experience sampling in the context of ethnographic observation, it is important to first build rapport with the participant. For example, we first met with Marcus, one of our participants, over lunch before he attended his afternoon lecture, we met with him again afterwards and in total spent several hours talking more broadly about his daily life, interests, history, and social ecology, and observing his surroundings (his favorite food stall, his commute home) with him before any experience sampling took place. When it came time for Marcus to cook (he does batch cooking once a week to unwind from the stresses of medical school), we first took a pause from his routine to train him on experience sampling. We took a candid tone throughout (“this might seem a little goofy but...”, “we’re going to be annoying flies on the wall buzzing every so often with a question...” ) to mitigate the “experimental” feel of the method, which is at odds with the everyday “deep hanging out” (Geertz 1998) feel of ethnography. It is important that the research participant ultimately feels familiar and comfortable with the method (and with being interrupted every so often with a question).

Experience sampling designs come in many shapes and forms. Time sampling probes the person at fixed intervals. Random sampling probes the person at random intervals throughout the activity. Event sampling probes the person during particular events. The rule-based approach of time sampling guarantees systematic data capture, but lacks the flexibility to capture the influence of interesting events that often lack clear beginnings and ends. When conducting experience sampling in an ethnographic context, a mixed approach can account for the open-ended nature of everyday contexts with its interruptions and surprises. We decided on a mix of time- and event sampling, in which we systematically probed the participant every two to four minutes during brief moments of downtime (e.g. pausing after draining the noodles), but encouraged the researcher to conduct additional probes whenever interesting events, as determined by the researcher, occurred (e.g. a paper towel accidentally getting caught on fire).

Experience sampling design includes not just how often sampling occurs, but also what is asked of participants. Because of our research question and project goals, we used a subjective mental effort rating scale: participants are asked to report answers to the question “How much mental effort did you invest?” on a 9-point Likert scale ranging from *very, very low* to *very, very high* (Paas 1992). While having repeated quantitative measures proved to be very valuable for our project, the Paas scores (what we will refer to as “mental effort scores”) themselves gave us limited insight into the contextual factors that shape a person’s experience in a given moment. We needed more clues to understand how numerous factors influence a person’s mental state, including task complexity, engagement, emotions, social environment, and so on. Therefore, we asked participants to explain, in a few simple sentences, what they were thinking of, or other things that preoccupied their minds, after having reported their mental effort score — informally calling the qualitative adaption “Paas + why.”

There are many ways a participant can answer “why,” and it is important to strike a balance between providing room for freeform reflection and providing structure for reflections that can be compared across participants. Matthews et al. (2013) and Helton and Näswall (2015) uncovered three primary dimensions of so-called stress states (transient states during a task that permeate conscious awareness): engagement, distress, and worry, mirroring the “trilogy of psychology,” motivation, affect, and cognition. We developed the training material described above, to familiarize participants with experience sampling, such that it trained the participant not only on how to use numeric scales, but to begin to develop a sensitivity for breaking down their experience into component parts — asking them to reflect also on task difficulty, engagement, and feelings toward the task in their open-ended answers to toy problems we gave them as part of the training. We encouraged them to later consider these aspects when giving their “why” answers to the mental effort scores once cooking commenced. We used a modified version of the Weekday problems (Sweller 1993; Van Gog et al. 2012) — for example, “*Suppose tomorrow is Monday. What day of the week is five days after the day after tomorrow?*” (Schmeck et al., 2015) — that we altered to vary not only in difficulty (high, medium, low) but also in engagement (artificial high incentive, artificial low incentive). We imposed this variability in both difficulty and engagement to allow the participant to reflect on the *choice* as to how much effort to invest in a task. This is meant to mirror the fact that in a real-life context the difficulty of and the participant’s engagement in the activity will vary in ways we cannot control but in ways we want to *understand*.

The protocol was tested and refined during the initial research phase. One key learning was that some participants struggled to disentangle emotion from cognition (e.g. watching a movie may be very emotionally moving but require very little mental effort to comprehend or watch, unless it is in a foreign language or it causes someone to mind-wander and reminds them about a to-do list). This led to additions to the training protocol to help people disentangle the two dimensions while signaling that both dimensions are equally important. For instance, we asked participants to establish a “benchmark” by providing a previous experience in their own lives that they would consider a mental effort score of 1 and a mental effort score of 9, after they were trained on the concepts and toy problems. This allowed researchers to both correct any misunderstandings of the concepts and also to contextualize the participants’ later scores with other aspects of their lives, for richer qualitative data. We encouraged participants to report on emotions when asked “why” for their scores. But convincing participants of the researchers’ equal interest in emotion was complicated by the fact that we had no quantitative approach for measuring emotion as we did for effort. Some participants interpreted this difference to imply that their emotions were of secondary importance. Future work might benefit from developing such a scale and deploying it side-by-side with the mental effort scale in everyday contexts (see Fraser et al. 2012 for connections between emotion and cognitive load, and Lottridge et al. 2011 for conceptualizations and measurement strategies for emotion).

Combining experience sampling and mental effort scoring with ethnographic participant observation requires compromises to each of the methods. In this project, it required rapport-building (in part through the researcher’s candid self-reflection on the strangeness of the method) prior to experience sampling, and a mix of time- and event sampling using the researcher’s discretion and including room for open-ended reflections of “why” in addition to scores. Understanding mental effort required training to tease apart different aspects of everyday experience like types of stress, emotion versus cognition, and the choice to engage

in a challenging activity at all. These are all aspects that might be controlled for in a lab, but which we tried to capture and record the variability of in everyday contexts. Experience sampling in participant observation also created a setting that was more structured and with more interventions on the part of the researcher than in a classic ethnography. In these ways, disciplinary experts found themselves uncomfortable, and found the data less pristine than they would have hoped, but ultimately the fieldwork collected qualitative and quantitative data that explored context and human experience from various angles and with aspects that each discipline alone would not have been able to capture.

## Reconstructed Narratives with Video Playback

How does a researcher break down, in moment-by-moment sequence, another person's experience? The researcher can observe someone in real time, but that does not explore interiority (e.g. what is our participant Marcus deciding between as he's stirring the pot of noodles? What caused him to pause for so long by the window?). Researchers could interrupt that person at a steady cadence to probe deeply at interiority beyond the "Paas+why" experience sampling described above, but that would introduce an "observer effect" distortion. The in-depth questioning could prevent the participant from entering important and common subjective states such as "flow" states (Csikszentmihalyi 2008) or mind-wandering (Smallwood and Schooler 2015) that would otherwise typically occur when the participant is in the everyday context and that would be helpful for the researcher's understanding of what assistance, if any at all, a person might need in that context.

As our team puzzled over this problem, we began to look to what was in retrospect one of the techniques of narrative journalism: the reconstructed narrative interview (Menkedick 2018). Journalists who specialize in telling narrative stories deeply rooted in one "character's" experience rapidly learn the value of revisiting with an interview subject a particular event again and again; each visit adds a new layer of depth, and helps the journalist to recapture what it was like to live through that event. In designing our research, we settled on a version of this technique as a method to probe participants' experience of cooking in a way that was both deep, yet unobtrusive: we would allow the participant to perform his or her task with no questioning beyond the mental effort scores asked every two to four minutes, and only *after* the cooking was complete would we engage the participant in an interview of approximately 60 minutes (sometimes longer) to immediately reconstruct, with as much fidelity as possible, what the interior experience of the just-completed task had been, particularly during a few moments of interest informed by steep changes in the mental effort scores they reported. For each participant we did this process twice, after each of the two activities. Crucially, we scrolled through the just-captured first-person video of the participant doing the activity during the interview to guide the questioning.

With in-situ fieldwork, researchers have an advantage over the journalist, as well as a disadvantage. The advantage is presence. Journalists are rarely physically present during the "scenes" or moments they later seek to reconstruct in their subjects' lives. By contrast, researchers in-situ are able to quietly observe and take notes about the scenes they will shortly try to reconstruct. Research can be set up to have the further advantage of being able to conduct the debrief interview *immediately* following the task; a narrative journalist often is piecing together events that date back years or even decades. The disadvantage is that researchers are seeking to reconstruct the experience of essentially banal events (e.g. doing

laundry), and on a more minute time scale than a journalist would try to explore (e.g. returning the shirt to the ironing board just when it seemed like the shirt was done getting ironed). Very seldom does a journalist attempt to reconstruct how a person's experience shifted across the course of a second, and never would a journalist expect a subject to remember with any fidelity the precise order in which the subject executed essentially banal tasks, like whether salt was added to a broth before pepper, and why.

Video footage can be used to overcome this challenge. In our study, we decided to play back to participants the video that had been recorded of them performing the cooking task using a head-mounted camera. (During the second activity of the participants' choosing, there was only an in-room camera recording the activity. We decided on this approach in case the head-mounted camera proved to be too disruptive for the participants' experience, but participants reflected that for the most part they forgot about the head-mounted camera after a few minutes of cooking.) This video, if instantly replay-able, serves as a kind of memory prosthetic to assist reconstructive narrative interviewing; the first-person perspective of the camera view further helps the participant relive the experience of the hour before. For instance, vision darting from one ingredient to another could help the participant viscerally remember a moment's indecision over how to proceed with a recipe. (We also realized that participants were much more comfortable watching first-person video of themselves than room-camera video of themselves that often made participants feel self-conscious.)

The reconstructed narrative with video playback can take longer than doing the activity itself, but it is this time investment that allows for deep probing into what would otherwise remain unseen or untranslatable to the researcher — a furrowed brow, a pause, a chuckle. Moments that are apt for deep discussion can be selected by both the researchers, looking back on their notes, and the participants, recalling something they had thought about but didn't say aloud at the time. Following the cooking task, we sat down with the participant and spent about an hour reviewing moments of special interest with the participant. Moments of interest were chosen at the researcher's discretion, but often involved spikes or significant fluctuations of mental effort as recorded from the mental effort score self-reports, moments of clear task-switching, moments of interruption, or moments the researchers had trouble deciphering. The researchers also allowed the participants to highlight moments that to the researchers seemed uneventful but where internally within the participant there was a lot of activity. For instance, one participant Haley noted that when she was waiting for the tofu to brown she was reminded of a reply she was waiting on from a love interest. The researchers soon discovered that to thoroughly explain everything that influenced the participant's experience during a moment of high complexity — even if that moment only lasted 30 seconds — could easily take 20 minutes of exhaustive probing through repeated playback of the video clip.

To give one example: one researcher witnessed a participant, Daryl: 1) have a dialogue with his wife about a task related to their young daughter's pajamas, 2) make a note about this task on a nearby whiteboard, 3) rapidly decide to execute the task immediately instead, thereby abandoning his borscht recipe for the moment, 4) quickly visit different drawers in his daughter's bedroom (captured for the ethnographer only due to Daryl's wearing a head-mounted camera, as he had darted away from the kitchen at this point), 5) visit a drying machine to grab a pair of pajamas, then 6) finally return to his borscht. Puzzling out all of these decisions, and the sub-decisions within these decisions, was a laborious (if joyful) task

for the researcher, necessitating digressive interviews about the state of Daryl's relationship with his wife, his young daughter's aversion to wearing pajamas, and a history of the participant's forgetting to execute tasks placed on the family chore-board. The entire video clip lasted perhaps just 30 seconds, but the exhaustive and fully explanatory account of the *meaning* of it ran for several hundreds of words.

This method of narrative reconstruction using first-person point of view video playback builds on participatory ethnographic video practices (see for example Pink 2007, 103-115), and places emphasis on the research participant's role in interpreting and making sense of their own experiences, rather than leaving the interpretation and sensemaking to the researcher alone upon return from the field (as may often be the case for the ethnographer) or from the lab (as may often be the case for the cognitive scientist). As anthropologist João Biehl writes, "How can the lives of our informants and collaborators, and the counter-knowledges that they fashion, become alternative figures of thought that might animate comparative work [...]? [...] As anthropologists, [...] we are challenged to listen to people — their self-understandings, their storytelling, their own concept work — with deliberate openness to life in all its refractions" (Biehl 2013, pp 574-6). This is perhaps another way in which hybrid methodology seeks to push the boundaries of research — by bringing participants more actively into the sensemaking process — and future work might benefit from developing this aspect further. Providing research participants more opportunities to articulate their internal states, including what they need and what they *don't* need, rather than assuming or inferring from observations alone, seems particularly important for determining the relevance, helpfulness, and boundaries of an assistive technology in everyday contexts.

## **HYBRID METHODOLOGY ANALYSIS: ANALYZING DATA WITH COMPLEMENTARY APPROACHES**

Because of the mix of methods combined in research, hybrid methodology generates a substantial amount of data of different types (e.g. numerical scores, observational field notes, images, video recordings). Given the wealth of data collected, many analysis strategies are possible in order to make sense of that data. The interdisciplinary team needs to choose which means of analyses to prioritize and combine in ways that best serve the research question (rather than in ways that best serve each discipline). In the case of complex research questions (e.g. what is the human experience of context?), conducting complementary analyses that make simultaneous entry points into the data allows the team to explore the research question from different angles and to revisit the data later on as distinct disciplines follow particular tracks to explore a sub-component of the research question more in-depth.

In this section we present a selection of complementary analyses that we conducted, which combined qualitative and quantitative approaches. These analyses are part of a larger pattern recognition or "Sensemaking" process (Madsbjerg and Rasmussen 2014; also described in Hou and Holme 2015), in which teams use "bottom-up" data-driven approaches (i.e. based on what we see in the field) alongside "top-down" theme-driven approaches (i.e. based on the themes we sought to explore at the outset and questions we needed answers to). In our case, we wanted the results of the analyses to help inform the early design of new assistance experiences, the research agenda for further studies (in a lab and in the field) based on new questions emerging from the work, and the early development of infrastructure for new assistive personal computing technology.

## Structured Storytelling and Qualitative Data Clustering

How do teams ensure that all researchers are familiar with the details of the raw data and have a shared starting point, particularly when each researcher met with only a subset of participants? How do we enable researchers to discern themes across distinct moments in the field? We took what we informally called “structured storytelling” as our starting point in analysis: a discussion centered on each of the research participants, led by the researchers who met with that participant, and structured around key questions and instances from the field that the team wants to systematically and consistently probe for details. This ensures that human voices and experiences are top of mind — the participants are not abstracted as “Subject A” or as data points on a graph, but instead as individuals with names (we used pseudonyms to protect identity). It also ensures all team members have a shared grasp of the details and particularities of the fieldwork, from which (when those details are compared, connected, and abstracted) insights tend to emerge.

In the discussions, the team focused on concrete moments observed in the field — Dina doing laundry, or Mitchell tending to his indoor garden. This involved re-watching video footage around moments that were quantitatively interesting because the participant reported a very high or very low mental effort score, and moments that were qualitatively interesting because of an ethnographically rich observation (e.g. a moment the participant identified as meaningful upon reflection after the activity was done or a moment the researcher noticed as having many contextual dimensions at play). The purpose of structured storytelling is to interrogate the raw data with pertinent lines of questioning that help the team to interpret what happened in the field. Some of the questions we asked as a team included, “What dimensions of the context were especially relevant for the individual in this moment?” “What type of information was the individual engaged with?” “What other moments from the field, from this participant or other participants, might be similar to this one, and why?”

Structured storytelling stems from grounded theory, a methodology used in sociology and anthropology to generate theories based on systematic analysis of qualitative data rather than using data to confirm or refute a hypothesis, or building research around an existing theory (Glaser and Strauss 2017). Structured storytelling, as described above, generates interpretive descriptions or reflections that the team members then write down individually (e.g. on post-it notes or note cards) and aggregate collectively. This content, in turn, leads the team to do qualitative data clustering, which entails making further sense of the interpretive descriptions by grouping them into thematic buckets based on commonalities. These buckets are then analyzed, connected, and compared to develop working theories or insights. The development of these theories requires a constant “zooming out and in” — once there is a potential insight (i.e. a working theory that explains observations from the field), it is necessary to go back to the raw data itself to collect other moments (e.g. moments that corresponded with similar mental effort score, or moments that were ethnographically rich) that support, nuance, or challenge the proto-insight, for its refinement.

A team can tell whether or not the structured storytelling and qualitative data clustering are going in the right direction if there is a certain productiveness to the hypotheses or proto-insights — these are helping to reframe or give new meaning to moments in the field not otherwise considered, are leading to other proto-insights, or are providing structure and

groupings in an otherwise fragmented data set of moments from the field. The purpose is to develop high-level insights that address the project's research questions and ambitions — in our case, about the role of different dimensions of context on a person's experience that then informed the abstractions we developed for a data labelling protocol, described in the Impact section. The abstractions we developed (which we refer to in this paper as Abstraction Set A and Set B and which can be thought of as an early framework that *informs* the later framework the assistive technology itself might eventually use) were based on the strongest patterns in our qualitative data clustering exercises and the relationships those patterns had to the quantitative analysis we will now describe.

## Quantitative Analysis of Ethnographic Data

To allow machine learning models and cognitive science research to benefit from insights derived from qualitative analysis, we need to also find complementary quantitative methods for data analysis. How do teams work quantitatively with data captured in ethnographic research? Quantitative analysis of ethnographic data entails developing an approach to data processing and graphical representation to best serve the team's goals. We had three learnings that could be useful for teams doing this type of work: First, if in doubt about what type of quantitative analysis will prove useful, the team should develop multiple initial representations of the same data to enable a variety of early insights. Second, the team should seek ways to compare data points consistently and systematically even when individual research participants' experiences or real-world contexts and interpretations of tested concept are highly variable. Third, the team should explore connections between the quantitative and qualitative data to better understand the results of the quantitative analyses and address project goals (e.g. in our case going back to the thick descriptions associated with extreme mental effort scores to find other patterns in this data).

One of our goals was to obtain generalizable patterns about mental effort from the mental effort scores. The challenge is that, given the uncontrolled situations we were studying, the mental effort scores were generally not comparable across participants because of variable real-world contexts and because of individual differences in how participants interpreted the mental effort scale. This is a common problem with all self-report scales. For example, one participant never gave a maximum score of 9 (always hovering around 6s or 7s at the extreme), but her qualitative *description* of a moment was very similar to another participant's description for a 9 score. This left us with an interesting question: Can mental effort scores be compared across different activities for the same participant, and across participants?

We plotted the mental effort scores for each participant's two activities first in box-and-whisker plots, which allowed us to visualize the median mental effort score the participant gave for that activity, as well as the upper and lower quartiles of that median and the upper and lower extremes (moments when the participant gave a really high score or a really low score, outside of the norm of scores they were otherwise providing). We were able to contextualize these plots with what we knew qualitatively about each participant, to identify patterns in how each participant "typically" scores mental effort (e.g. Marcus loves cooking and it's easy for him, whereas he doesn't enjoy studying and finds the material difficult, but there are relative "extremes" in each activity, with distinct needs, and those might have

similarities to another participant's, when we begin to abstract out through the qualitative data clustering).

In order to paint a picture of how each participant's mental effort reports shifted over time, we made another set of mental effort score plots with score values on the y-axis and time on the x-axis. This provided a "story arc" of how an activity unfolded in terms of mental effort from start to finish, which we could then contextualize with qualitative data (e.g. Dina did laundry late in the day feeling rushed to get it done while the food was cooking, so perhaps that's why the "arc" of the activity looks the way it does). We could also compare the mental effort score arc with what we knew from the reconstructed narratives in the field (e.g. when Haley's scores were low during a banal moment in cooking, we knew she was thinking about her romantic interest and about her work responsibilities). We were able to assess where our ethnographic observations differed from or aligned with the mental effort scores, and understand how two participants' needs, when compared, were distinct even when they each gave a score of 9 during a moment when they were each cooking.

To better visualize the set of high mental effort "outliers" (the particularly rich moments from a cognitive science point of view) and identify clusters (similar patterns) between participants, we calculated the mean and standard deviation of the mental effort scores across both activities for each participant, plotted in temporal sequence (how the mental effort scores changed over time for each participant). High outliers were defined as those that fell in the top 10% of the distribution for a participant. Because we had qualitative notes accompanying each score, we were able to interpret and theorize about why a moment was an extreme high or low score, for that individual, and find patterns among the "why's" behind the relative extreme scores. This data informed subsequent analyses conducted by the cognitive scientists on our team (Jonker et al. in review).

Multiple forms of analyses are possible on, and can enrich our understanding of, a hybridized data set, to provide more directional outcomes. Together these approaches set our team up to explore further cognitive science questions around mental effort, and to explore further questions around helpful abstractions to inform machine learning (some of which is described in the Impact section that follows). Hybrid Methodology is amenable to subsequent analyses that build on or depart from the initial analysis of the data, both because there are many "kinds" of data (e.g. quantitative, qualitative, self-reports, interpretation) to work with and because there are disciplinary experts who are already familiar with that data from the interdisciplinary work.

## **HYBRID METHODOLOGY IMPACT: GOING BACK TO OUR INTELLECTUAL COMMUNITIES WITH RELEVANT FINDINGS**

Having multiple analytical entry points into a hybrid methodology data set can provide a team opportunity to make impact in a variety of ways and for different intellectual communities (both company-internal and external). The richness and variety of the hybrid methodology data set, and the analyses described above, left our team poised to develop work products (i.e. outputs, deliverables) that generated impactful early outcomes for context-aware assistive technology, including: (1) shaping early user experience design, (2) informing the research agenda for future studies in cognitive science, and (3) developing nascent research on infrastructure for assistive technologies. Together these follow-on



projects represent a portfolio approach to delivering impact from a hybrid methodology data set, leveraging and extending the data and analysis in different ways.

Each of these three follow-on projects had distinct ambitions for how to deliver relevant findings to the “home discipline” intellectual communities that came together at the outset of our hybrid methodology project. The follow-on projects offer contrasting approaches to extending the analysis and application of a hybrid methodology data set, and suggest ways that qualitative data could be used in machine learning and cognitive science. The first two of our listed outcomes were in sense more straightforward or familiar. One involved envisioning a series of end-user design concepts based on the insights — means of interventions, broadly, that users might find helpful. The other involved addressing a single cognitive science research question emerging from the analysis of outlier mental effort scores (Jonker et al. in review).

This section focuses on the third on the list — a follow-on project focused on technology infrastructure development — to illustrate a form of impact that can be created through work products that may be novel in applied ethnography. This project involved developing and partially implementing two data labelling protocols based on abstractions deemed potentially useful for context-aware assistive technology. The abstractions, protocols, and resulting labelled data set each served an early informative role in infrastructure development.

Building frameworks or abstractions that make sense of the human, social world should feel familiar to applied ethnographers. Abstractions are also the foundation for making any machine learning possible. Without abstractions, machine learning models would have to cope with an infinite amount of categories with one data point each. For example, we might use the abstraction of a dog to build machine learning models that are able to detect dogs across breed, age, size, and so on. In our setting, the most useful level of abstraction would allow a machine learning model to reduce the inherent complexity of context and to hone in on what is most relevant for the human in a given moment.

To guide the development of useful abstractions, we studied the literature of conversational agents, or chatbots, an area where researchers have encountered similar challenges in terms of complexity. Our task involved us attempting to “read” and interpret a context for meaning. Similarly, chatbot-development involves seeking to extract “meaning” embedded in the syntax of language, treating a text as more than a sequence of words. Recent work has shown how hierarchies of abstractions can improve the performance of chatbots. In particular, research scientists Khatri et al. (2018) find that incorporating dialogue acts, inspired by philosopher John Searle (1969), can improve the performance of their contextual topic model for dialogue systems.

Inspired by recent advances in the field of conversational agents, we developed two sets of abstractions, Set A and Set B, that repackaged and represented the strongest patterns around the experience of context emerging from our hybrid analysis processes. Abstraction Set A was more holistic (more “zoomed out” in its representation of aspects of context) whereas Abstraction Set B was more granular, and broke down context into several components. Each abstraction set was mutually constitutive of the other (i.e. each abstraction set represented and reframed the content of the other), but each was also independent of the other (i.e. one set did not need the other set in order to be legible).

Our abstractions served as the foundation for the development of several data labelling protocols, which consisted of a set of instructions for how to generate a labelled data set of

human experience of context. Ultimately, this labelled data set is needed to train a machine learning model to detect Abstraction Set A and B. In order for annotators to be able to label a piece of data as a given abstraction, they need to know what the abstraction is, which in our case was not as straightforward as, for instance, labelling whether or not an image contains a dog. Most of us share an understanding of the abstraction of a dog, and we have no difficulty pointing at examples. In comparison to the abstraction of a dog, Abstraction Set A and Set B were more ambiguous, and closer to concepts such as “freedom” or “democracy.” There is a rich tradition in the social sciences for how to reliably encode data with abstract concepts. Political science, in particular, contains several examples such as the Polity data, which rates countries on a numeric scale from democratic to authoritarian, the Comparative Manifesto Project, containing coded summaries of political party manifestos, an often-used source for placing parties on a left-right scale, or Transparency International’s yearly corruption perceptions index.

Traditionally, and in all three examples mentioned above, data that involves more abstract concepts are generated by experts, often academics with deep subject matter expertise. However, to generate data at sufficient scale to train a machine learning model, we need to be able to move beyond experts who are generally costly and in short supply. Thus, we needed to ensure annotators had a sufficiently nuanced understanding of our abstractions to be able to label data *as if* they were experts without requiring them to be trained ethnographers or have deep knowledge of our project — they abstractions needed to be teachable. Further, they needed to be able to detect an abstraction from video and audio alone, without access to our field notes. Despite the lower expertise of naive annotators, recent research indicates that deploying crowd-sourcing can generate results that are indistinguishable from expert approaches (see Benoit et al. 2016 for an example in the context of political texts).

Teaching new abstract concepts is hard. We took an examples-based approach, in which the abstractions were primarily taught through instructive examples in the form of brief video clips from our field recordings. We first provided the annotators a brief description of the abstraction. Afterwards, the annotators were shown three examples that highlight various aspects of the abstraction. The first example is a prototype of the given abstraction. This is the clearest illustration of the abstraction we have in our data. However, a clear example is not enough to be able to meaningfully label data from long-form video. It is equally important that annotators understand that moments can vary along important dimensions and still belong to the same abstraction. For this reason, we provide two additional examples that highlight meaningful variation within the abstraction. These examples helped annotators understand the different dimensions of an abstraction, which in turn helped them set boundaries and differentiate between various abstractions. Ideally we would have had a fuller training set, of several examples with a lot of variety for each abstraction, but at the time we had three training examples for each. Ultimately, the labelling protocol needs to strike a balance between sharing enough information to learn the abstraction but not so much information that the protocol starts to resemble an exhaustive catalog of variants.

Testing the annotators required a validation strategy. We were looking to test the degree to which the naive annotators were able to replicate our “expert” labels. To develop a benchmark, we took a piece of data and labelled it based on consensus among us as researchers over whether or not a given abstraction was present in the data. We did this for Abstraction Set A and Abstraction Set B, because we wanted to compare results and see

which abstraction set was more easily learnable for naive annotators. Establishing this benchmark collaboratively, as an interdisciplinary team, meant an iterative discussion and refinement of what the definitions of the abstractions themselves were.

Training and testing annotators on the abstractions took a full day, and the data set available was modest (50 hours of video footage), as it came directly from the fieldwork. The team provided the training and assessed annotators as a group and individually against the benchmark data set, labelled by us. At this phase of the project the ambition was not to develop training data for a machine learning model, but to explore whether it was possible for a group of naive annotators to learn and apply our abstractions. Going forward, we envision a process where naive annotators are initially screened based on their ability to replicate our “expert” labels. After this screening, new data should be labelled based on majority voting among selected annotators, as is common in the literature (e.g., Fridman et al. 2019).

Our initial results are mainly positive. Overall, annotators had above-chance ability to agree with our labels, with the best-performing annotators missing the benchmark by only 5%. For the most part, there was relatively high intra-rater agreement between the naive annotators, indicating that different naive annotators would be able to independently reproduce approximately our abstraction labels. The team found that the best performing naive annotators understood and implemented the “rules” for coding (e.g. all abstractions in Abstraction Set A are mutually exclusive) and shared an understanding of the granularity of the labelling task. Difficulties in this area invited errors of two kinds: either parsing the long form video data too granularly (applying labels to less than salient evidence of an abstraction) or not granularly enough (failing to apply labels to salient evidence of an abstraction).

In our testing phase, we also captured, but have not yet analysed, annotators’ certainty when labelling a given piece of data, as well as both point estimates and ranges of start and end times for a given abstraction. These data allow us to analyse accuracy across different levels of (un)certainly, and understand the degree to which annotators disagree about when an abstraction starts and ends. We also allowed annotators to tag and suggest new potential abstraction labels within Abstraction Set A or B (whichever one they were coding), as a way to generate new potential abstractions that could be refined in further analysis going forward.

This process of developing a data labelling protocol led to some overall lessons on making work products from hybrid ethnography that are relevant to specific intellectual communities. Applied ethnographers should have the ability to recognize the limits of work products and their utility — for instance, abstractions alone are not useful in building technology infrastructure. Indeed, applied ethnography often deals in abstractions or frameworks but does not often go a step further and apply them to machine learning problems — to do this ethnographers need to build another kind of work product, namely data labelling protocols. Developing data labelling protocols requires developing training material that links abstractions back to very concrete, detectable, recognizable examples in the data. This requires, at a certain point in a project, moving away from the nuance and complexity of ethnographic thinking and being quite firm and mutually exclusive about what something is or isn’t in order for labelling to be possible. Establishing benchmarks (for the annotators to learn) requires consensus among the researchers, and iteration and refinement of the abstractions themselves in the process, as researchers are forced to be very clear about

what something is or isn't. We have found that this process helps to sharpen the precision of the original concepts themselves. Labels must then be tested with annotators, who look at raw data and label based on the learned abstractions — and here what we discovered is that inter-rater reliability when dealing with such complex topics (human experience of context) might be lower than what is organizationally common or acceptable, and that annotator training for such complex topics is time-consuming and research-intensive.

Overall, if applied ethnographers want to influence infrastructures like those that support context-aware assistive technologies, these teams are greatly helped by a willingness to extend their frameworks and use them to form new work products. In our case of hybrid methodology we did so by extending our abstractions into a tested data labelling protocol, in addition to informing experience design and the research agenda for cognitive science teams.

## **HYBRID METHODOLOGY PROCESS: GUIDELINES FOR THE PROCESS OF INTERDISCIPLINARY TEAM COLLABORATION**

Research that is both interdisciplinary and collaborative requires a balancing act between the practices of one discipline and another, such that the team develops new hybrid practices — this in turn means that working together is a process that cannot be taken for granted. The sections above have outlined the key hybrid methodology approaches for research, analysis, and impact. What follows are guidelines for effective collaboration within an interdisciplinary team, the order of the points organized by when in the project process that point is most relevant and useful (from framing to analysis), with the last point being about the general ethos throughout a project, based on our learnings.

### **Let the Research Question Be the Team's Home Base**

For complex research questions, we need to flip the decision-making process on its head. Rather than using a discipline to define the methodology, we instead let the research question drive the methodology decisions. The major advantage of a highly interdisciplinary team is that it unlocks a large set of tools and methods that can be used to answer a central research question. We found that certain methods came to the fore at distinct stages of our research, and that each discipline had something crucial to contribute at different stages of the design and analysis, so we strove to set aside the mentality of “this is how we conduct research in Discipline X” and instead adopt the thinking, “this is how we best answer Question Y.” The resulting process is more than interdisciplinary; the cross-pollination and switching between methods becomes so frequent and fluid as to create something more like a *hybrid* — hence hybrid methodology.

### **Prepare for an Immersion Into Each Other's Fields**

Interdisciplinary projects work best when each discipline is given opportunity to contribute, but also when each discipline understands the other. This is not simply learning about each discipline's methodologies and problem-solving approaches, but deeply understanding their perspectives and world views. We would advocate for an early immersion, in which each disciplinary expert spends the day shadowing the other, trying to understand how each views the world. This entails listening and observing with openness —

what does the workflow for a machine learning engineer actually look like? How does a cognitive scientist run an experiment? How does an ethnographer conduct participant observation in the field? Each discipline expert should spend some time in the role of the other prior to fieldwork. When in the field, this spirit of immersion in each other's perspectives can continue by having researchers with different expertise gather data together. We agreed that two researchers, each from a different discipline, should go into the field together to meet with each participant. This setup gives researchers with a range of knowledge a shared perspective from which to draw — they can discuss how they, in pairs, observed or noted different aspects of the same context, having both been in the field.

### **Build in the Ability to Iterate Extensively**

Interdisciplinary projects require constant developing and improving of approaches based on contributions across disciplines and shared learnings as a unit. We advocate for building in ways to iterate throughout the process. For example, data collection might be structured so that it occurs in two parts with a break in-between to assess and refine approaches and develop early insights. The team can then reconvene at the end of the second part of data collection to review the revised approaches and analyze the data. The discipline experts should regularly review and weigh in on analyses in progress. Time and logistics for this iteration should be built into the project timeline and scope — for instance, ensuring all experts have opportunities to meet and work together in real-time at key moments in the research when approaches are being built, assessed, or (if necessary) rebuilt. This may not be unique to hybrid methodology, but it is likely especially critical given the diversity of the research and researchers.

### **Work with Fuzzy Definitions and Cross-Disciplinary Translations**

Language becomes especially important in interdisciplinary projects, as different disciplines might have different definitions of the same term (e.g., “context”) or terms might not yet exist for newly observed phenomena. It is vital to do translation exercises across disciplines, particularly with terms that are common among the disciplines but defined differently in each — for instance, how do machine learning concepts map onto anthropological concepts (e.g. “abstraction” and “pattern”), and how do cognitive science understandings of experience map onto phenomenological and philosophical understandings (e.g. emotion and effort)? In cases where a phenomenon is not well defined by either discipline, new language emerges. We found ourselves working with fuzzy definitions, making a point to talk about what we did not fully know yet, in an effort to define as we went along what these terms meant (for example, the terms we used to break down the components of context), and working toward more concreteness of terms over the course of the project.

### **Recognize the Value of Different Types of Data**

“Data” is one of those terms that is common across disciplines and yet comes in unique forms, from pixels to 0s and 1s to the thick description of a wink (Geertz 1973). Interdisciplinary projects benefit from the full team re-defining “data,” such that each

discipline feels that there is both familiar and unfamiliar data being captured. It is important to recognize the value in unfamiliar data and to recognize that data which feels unusable for one discipline is actually incredibly relevant in another. Many disciplines (anthropology, machine learning, cognitive science) value taking a data-driven approach, but that “data” itself may look very different for each discipline.

### **Find the Highest Helpful Level of Abstraction**

In order for an insight or concept (e.g. about human experience or human behavior) to be relevant and actionable across disciplines, it needs to have a certain level of abstraction from raw data so that it translates not only across individual data points but across different disciplines, yet it cannot be so abstract that it loses too much specificity and actionability, rendering it meaningless for each discipline. In our case, abstractions ideally allow us to develop knowledge that generalizes beyond any one individual’s experience of context, to allow for actionability or relevance beyond our participant pool. For example, it might be too abstract to say that social interactions are one aspect of context that impacts experience, but to say that certain types of social interactions (e.g. caretaking, collaboration) impact the experience of context might be at the “right” level of abstraction to be directive about what value to offer in interventions or how to build for those interventions. In our project we have learned the value of ‘imperfectly useful abstractions’ that helped us to generalize enough given we were addressing a technology that doesn’t yet exist, and yet that required constant re-evaluation and adjustments to the granularity of the abstraction (similar to our points about fuzzy definitions and translations above). Abstractions help us to pinpoint relevancy. In the words of scientist and engineer Edsger W Dijkstra, “[...] the purpose of abstracting is not to be vague, but to create a new semantic level in which one can be absolutely precise” (Dijkstra 1972, 864).

### **Know When and How to Shift between Description and Interpretation**

In our project, we constantly discussed toggling between “bottom-up” and “top-down” analysis — and essentially this was a discussion about when to dwell in description and when to dwell in interpretation. It has been vital for us to have a high degree of granularity in the data (knowing that the data itself takes various forms), and staying close to the data for perhaps longer than on other applied projects, before reaching conclusions. But it has also been vital for us to move towards interpretation perhaps sooner than felt comfortable in other traditional within-discipline approaches (because given the quantity and quality of data captured, and the unfamiliarity with some of the data, we could have stayed close to the data for a long time). Moving to interpretation of the data allows us to build initial ontologies and categories for how to sort and make sense of the data, tying it to clear implications for what it is we are trying to inform. What has been most vital is the *shifting* between description and interpretation and back again — once we have some potential interpretations, going back to the descriptions to re-evaluate and refine.

## **Know When and How to Shift Between *Talking About* Approaches for How to Do Work and *Using* Approaches To Do Work**

A consequence of having a process that cannot be taken for granted is that the team must make deliberate decisions and reach consensus on what teams would otherwise intuitively dive straight into doing — and this takes time. For example, once a disciplinary team has its data, that team generally knows how to analyze that data; this was not the case with us. We spent a considerable amount of time discussing which analysis approaches we would need in order to answer our project's questions, debating the pros and cons of each approach (and in these discussions it can be initially difficult for value judgements to not come into play, particularly about what data or results should look like). While these discussions were certainly crucial, we had to learn when to stop talking and start doing (or trying-to-do), in order to achieve tangible results. In such interdisciplinary situations, deciding on an approach can seem scary and wrong — what if it turns out the approach doesn't work and ends up being a waste of time? But when it felt like the team had spent too much time on a “meta” discussion about what to do, we learned to time-box discussions and instead invest the time the team would have spent debating the approaches into instead testing one or two (even for just a couple of hours), then regrouping. The fruitfulness of an approach can sometimes only be assessed by giving it a try and looking at the results. Instead of resolving methods debates based on “best practice,” interdisciplinary projects may need to resolve these debates based on “the shoe that fits.”

## **Seek Out Methodological Bricolage**

In all, we have learned that interdisciplinary projects require some discomfort and compromise. Methodologies and approaches require give-and-take — no methodology is going to work as neatly as it would in its home-discipline. The orientation of the group should be towards a methodological bricolage of sorts: melding together traditional approaches in untraditional ways to make something new. Each discipline should be constantly looking to the edges of the field (e.g. how can we ask for scores of people's mental effort in-the-moment that take into account the reasons why the scores were given? How can we break a moment phenomenologically down to a handful of seconds in collaboration with participants?). This approach ultimately pushes each discipline further, together.

## **DISCUSSION: CONTEXT-AWARE ASSISTIVE TECHNOLOGY, HYBRID METHODOLOGY, AND THE IMPACT OF ETHNOGRAPHERS**

### **Context-Aware Assistive Technology**

Hybrid methodology has proven useful in beginning to address the complex problem of understanding the individual experience of context for personal computing and assistive technology. For instance, the study's findings indicate that people's broader goals and their social context and relationships play a critical role in characterizing high mental effort, even

more so than environmental and task-based context (Jonker et al. in review). From a practical standpoint, these findings identify the most worthwhile context factors to pursue in future cognitive science and machine learning research. Moreover, the study has helped create new terms (or abstractions) to define different experiences of context, and different components of context that become relevant to an individual. This has challenged the notion that context — in particular, mental effort in context — is only experienced in terms of highs and lows, more or less, good or bad. It has even challenged the assumption that mental effort is a singular construct — it may in fact be the case that there are several “flavors” of mental effort in the real world (Jonker et al. in review). A deeper understanding of context has sought to help inform some of the success criteria of context-aware assistive technology that does not yet exist yet — assistive technology that perhaps knows not only what to intervene with, when, and how, but also when *not* to intervene. There are many unanswered questions about how assistive technology can help, rather than hinder, how people want to act upon their world, but hopefully there is now also the beginning of a collaborative way to talk about those questions.

## Hybrid Methodology

Hybrid methodology presents an opportunity (and challenge) for disciplines to move beyond comfort zones. For anthropologists, it can mean coming up with a theory for understanding very messy and complicated contexts in a way that yields insights relevant to machine learning and cognitive science. For cognitive scientists it can mean exploring how lab studies and field studies build on or supplement one another, and how isolated variables studied in a lab (such as cognitive load during a puzzle challenge) can be studied systematically in everyday contexts alongside a number of other variables (such as emotion or mind-wandering) to further inform an understanding of cognition. For data and computer scientists and engineers it can mean understanding how qualitative data might provide helpful abstractions that can uncover new value propositions for machine learning and feature engineering. Across disciplines, there is an opportunity and challenge to explore how qualitative and quantitative analyses can work together on a shared data set. We hope that future interdisciplinary teams (particularly teams that bring *new* disciplines into the mix beyond the ones here) develop new methods at the intersection of existing ones, and new ways of analyzing, and defining what constitutes as, data. We hope these teams develop new types of outcomes that are relevant and impactful in “home disciplines,” and new processes for collaborating to best bring out what is both at the core and the cutting edge of each discipline.

## Next Steps for Ethnographers

Ethnography, in theory, holds promise complementing the approaches of machine learning and cognitive science, and addressing the challenges inherent in highly-controlled lab settings because it is embedded in the everyday, complex, “messy” reality of human life. Ethnographers are experts of context, abstracting out from thick descriptions of individuals. An algorithmic model, too, needs to be able to generalize to similar contexts and similar groups of users. Ethnography could have the potential to provide useful abstractions, descriptions and re-descriptions of the data that can inspire machine learning scientists to



engineer new features that they had not before considered. It could help engineers determine what data and sensors to prioritize from the end-user's perspective. Ethnography could also have the potential to both augment quantitative metrics on cognition (such as mental effort highs and lows) with qualitative descriptors, and help to record such measurements more seamlessly in naturalistic settings. This contribution is deeply valuable because knowing that metrics like mental effort are high or low does not do enough to inform the device of when and how to intervene, or if it should intervene at all. The device also needs to know *why and how* mental effort spikes or drops because of an individual's experience of context. Ethnography can perform the knowledge discovery to scope out a space for future data collection and machine learning.

But ethnography, in practice, has yet to truly integrate into the early development of how these ubiquitous technologies work — both their ability to parse context and their ability to support human cognition. User research and qualitative data are typically part of defining "what we build" while machine learning and cognitive science are typically part of defining "how we build" — and there is little collaboration. This setup works well enough when the machine learning researchers know which data they will need to use for more constrained problems and use cases, but in the enormous complexity of everyday contexts (i.e. "the real world"), ethnographers can generate data, insights, and deliverables that help to define and scope machine learning work and bring qualitative insights early into the shaping of technologies and capabilities that do not exist yet. This requires that ethnographers roll up their sleeves, understand new emerging spaces, dive deeply and openly into new disciplines, and adaptively build a hybrid methodology around emerging research questions. It requires rethinking ethnographic research and outputs, and making these understandable and relevant to collaborator-disciplines. Although it is a challenge, the applied ethnographers who are willing to take it on may find themselves contributing to the definition of the next wave of ubiquitous computing, and in the process pushing the boundaries of ethnography's methods and applications.

**Maria Cury** is a manager at ReD Associates. Currently Maria studies technology in daily life to advise on product development, and is interested in advancing applied ethnographic research methods. Maria received an MSc in Visual, Material, and Museum Anthropology from Oxford, and a BA in Anthropology with Visual Arts certificate from Princeton University. [mcu@redassociates.com](mailto:mcu@redassociates.com)

**Eryn Whitworth** is a post-doctoral research scientist at Facebook Reality Labs. Currently, Eryn is focused on advancing the practice and discourse in product user experience research through the development of new data representations and data sets depicting mundane activity. She received a PhD in information studies from the University of Texas at Austin. [eryn@fb.com](mailto:eryn@fb.com)

**Sebastian Barfort** is a data scientist at ReD Associates. Sebastian works with clients in technology, financial services and healthcare to translate ethnographic insights into algorithms. Sebastian received a PhD in behavioral economics from the University of Copenhagen and double master's degrees from London School of Economics and NYU. [sebastianbarfort@gmail.com](mailto:sebastianbarfort@gmail.com)

**Séréna Bochereau** is a technical program manager at Facebook Reality Labs. Séréna has a PhD in Haptics from Sorbonnes Universities and an MEng in Materials Science from University of Oxford. [sbochereau@fb.com](mailto:sbochereau@fb.com)

**Jonathan Browder** is a research scientist at Facebook Reality Labs. His research interests include multisensory perception, human behavior in augmented and virtual reality, and non-parametric modeling. He received a Ph.D. and MA from Washington University in St Louis and a BA from Washington and Lee University, all in mathematics. [jonathan.browder@oculus.com](mailto:jonathan.browder@oculus.com)

**Tanya Jonker** is a research scientist at Facebook Reality Labs. Her work focuses on interaction between futuristic technologies and human cognition. She is currently exploring input and interactions with augmented and mixed reality, and how these devices might enable new types of cognitive offloading. Tanya received a PhD in Cognitive Psychology from the University of Waterloo. [Tanya.Jonker@oculus.com](mailto:Tanya.Jonker@oculus.com)

**Sophie Kim** is a UX research scientist in Facebook Reality Labs at Facebook. Sophie focuses on bringing human-centered and experience-driven approaches to future-facing research and development. She has a special interest in augmented reality interactions and how ethnographic research can help inform it. Sophie received a PhD in Human Factors Engineering from Virginia Tech. [sophiekkim@fb.com](mailto:sophiekkim@fb.com)

**Mikkel Krenchel** is the Director of ReD Associates North America. He has spent a decade advising leaders across a wide range of Fortune 500 companies on corporate and product strategy, and led ReD's emerging practice for integrating social and data science. [mkr@redassociates.com](mailto:mkr@redassociates.com)

**Morgan Ramsey-Elliott** is a partner at ReD Associates, where he works with technology, financial services, and retail companies. He enjoys working at the intersection of “old” and “new,” advising on product strategy for both well-established companies striving to adapt to the digital economy, and digital-native companies growing into maturity. [mre@redassociates.com](mailto:mre@redassociates.com)

**Friederike Schüür**, PhD is a data and machine learning scientist. She leads machine learning efforts at Cityblock Health, serves on the data advisory board of USA for UNHCR, and she is a long-standing data science for social good volunteer with DataKind. She loves data in all its shapes and sizes. [friederike.schueuer@gmail.com](mailto:friederike.schueuer@gmail.com)

**David Zax** is a senior consultant at ReD Associates, where he has focused on conducting ethnographic research for tech companies. Prior to ReD he was a freelance journalist contributing to Fast Company, Technology Review, This American Life, and The New York Times. Contact: [David.zax@gmail.com](mailto:David.zax@gmail.com)

**Joanna Zhang** is a senior researcher at ReD Associates. In past lives, she's waitressed in NYC, coached high school debate, organized public health campaigns, designed for an

architecture studio, supported digital strategy at the White House, and dipped potato chips in chocolate by hand at a candy/hotdog shop. [ize@redassociates.com](mailto:ize@redassociates.com)

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## Case Studies Session

# Agency of the Affected

Curator: Thomas Y. Lee (University of California Berkeley)

The case studies in this session highlight the roles of data and agency in innovation, problem solving and design. From the various case studies, we can distill at least two different roles for data. First is the role of data in identifying and screening problems as opportunities to innovate. In *Designing for Dynamics of Agency in NYC Homeless Shelters*, Radywyl focuses on the role of both qualitative and quantitative data to surface and prioritize opportunities to improve move out rates from New York City homeless shelters. The case studies titled *Boundary Crossings* (Pietrykowski and Foster) and *Can Any Hairdresser Fix a Car* (Birckert and Montagu) are both concerned with labor shortages and maintaining or even improving manufacturing service quality. Second is the role of data in creating an IT artifact to address the problem. In *Bringing the Security Analyst into the Loop*, Rogers describes a visual representation that captures predictive models of potential network security threats as well as descriptive models of documentation supporting the predictions. The diagnostic tools described by Birckert and Montagu include predictive models to diagnose automotive faults and prescriptive models to optimize the repair process. The matching platform observed by Karn and Hutson is a prescriptive solution for matching drivers to riders subject to preferences such as safety, cleanliness, and one-way rides.

But an IT artifact is not itself a solution. As the papers all note, successful innovation requires a deep understanding of the contextual processes or customer journey in which an IT artifact resides. This is because an IT artifact is only one of many agents in the constellation of intra and inter organizational hierarchies that take part in the solution. Agency defines the alignment of decision rights, organizational imperatives, organizational structures, and incentives of all the affected agents. This means accounting for the agent incentives (Karn and Hutson; Radywyl), respecting labor relations and organizational hierarchies (Pietrykowski and Foster; Birckert and Montagu), and understanding the status quo journey to understand how an intervention can enhance rather than disrupt the existing culture (Radywyl; Pietrykowski and Foster; Birckert and Montagu; Rogers).

## Can Any Hairdresser Fix A Car?

### Mechanics Seeking Agency in Automated Car Diagnostic Contexts, and How Observing Agency Can Help Designing a Car Diagnostic Tool

CHLOÉ HUIE BRICKERT, *\_unknowns*

GUILLAUME MONTAGU, *\_unknowns*

*As part of an international research conducted for a French car manufacturer, a team of anthropologists and designers were asked to analyze the use of a car diagnostic tool by mechanics in their garages, in order to recommend ways of improving it. A single glance at the diagnostic tool's interface was enough to get a feel for mechanics' new reality: lines of codes and numbers, webpages filled with blue hyperlinks leading to readymade repair methods. Does being a mechanic in an automation era mean anything anymore? Based on findings from a study conducted in 5 countries with mixed ethnographic and UX methods, this case study explicits the interest of understanding mechanics as a profession - or even more, as an art - before studying the use of the tool itself, and mostly, it demonstrates how solutions can be contained in agency - and how design and tech teams can find inspiration from bypasses, local initiatives, and informal rituals. From supervising an international team of researchers to finding similarities among cultural specificities, this paper also questions ethics and investigates the role of a diagnostic tool in supporting mechanics' job evolution.*

*Key words: Automation, Ethnography, Design, Mixed Methods, Agency*

## INTRODUCTION

What strikes at first sight, when lifting a recent vehicle's hood, is the unintelligible entanglement of electronic components around the engine. To drivers, cars seem to progressively have become more electronic, autonomous - and mostly, obscure. To mechanics too - if not more. For decades, engineers have been transforming cars' systems into complex networks, introducing a sharp turn into the mechanical profession. Take away the throttle valve switch and you take away the essence of mechanics and their greasy overalls. Put in air conditioning and you take out the need for senses and guts. No touching, no smelling, no listening.

For quite a while, from the 19th century up to the mid-20th, vehicles were understood as "front-mounted gasoline engine, transmission behind that, drive wheels in the rear, all suspended on frame rails with a body on top" (Borg 2012, 28-29) - it was as simple as that. Cadillac's first electrical starters in 1912 were the premise of progressive complexification of cars systems. But mostly, it was the context of WWII and the Cold War that spawned technical uncertainty<sup>1</sup>, by encouraging innovation in the context of rivalry. Technical uncertainty extended in the 1960s and 1970s with uprising ecological concerns to reduce gas emissions. The 1970 Clean Air Act Amendments led to the creation of the catalytic converter and of the On-Board Diagnostic (OBD) system to access the data and control the gas emissions, making it the first human-machine interface.

From then on, embedding new technologies meant creating tools to translate the automated maintenance system for mechanics, instead of supporting olfaction, audition, or other senses that they had always relied on. But engineers seemed to have forgotten to take



the mechanics into consideration within the design process, imposing digital interfaces that didn't adapt to their work routines and habits. With each new generation of cars came new on-board technology, and with it new functionalities and processes, leading to major changes within the diagnostic tools.

In the context of revamping their diagnostic tool before launching the next model generation, the leading French car manufacturer asked the \_unknowns research & design team to help improving it. To the manufacturer, not only was it a necessity - as they were cutting profits to attract new customers, maintenance and service department had become a critical income source - making car diagnostics more efficient was also a major business issue, as well as an HR one. The entire industry faces a shortage in qualified technicians - partly because automated diagnostic systems have depreciated jobs, making them less attractive: for an increasing number of students, it isn't a vocation anymore (Mayersohn 2017). Revamping the diagnostic tool meant tackling several challenges: reducing overall diagnostic operations length, reducing the number of errors in maintenance, and developing mechanics' expertise and satisfaction with the diagnostic tool. Those challenges required a deep understanding of the job. It required to apprehend what diagnosing actually meant, and to figure out how the current diagnostic tools were really used within the garages. In short, the goal for the research was to observe mechanics' agency in an automated car diagnostic context. The \_unknowns researchers were integrated to the car manufacturer's engineering team in charge of redesigning the tool. Their role was to conduct an international study and provide UX guidelines to improve the usage of the diagnostic tool.

Before diving into the case study, side note: for those who aren't familiar with oily cylinders, injection pumps and mechanical matters (and the researchers themselves were first in line), what was mentioned as a "diagnostic tool" may sound enigmatic. To put it simply, it is a computer software which is plugged in and linked to a vehicle with a probe. It is used to interpret and command the vehicle processors and ECUs (Electronic Command Unit or Engine Command Unit). Almost all vehicles' functions can be measured and controlled through the diagnostic tool. From their laptops, mechanics can detect defective spark plugs, measure the play of an unbalanced crankshaft, and even start the engine. Mostly, diagnostic tools have become mandatory to diagnose cars faults and failures. Any malfunction imprints electronic records that are meticulously kept within the ECUs. Those records are interpreted through the diagnostic tool and used by the mechanics to find the failures' causes. Nowadays, as vehicles are supporting more and more automated systems, diagnostic tools tend to be more automated and prescriptive - therefore imposing a standardized way to diagnose onto the mechanics.

## **DESIGNING AN INTERNATIONAL STUDY**

When the \_unknowns research team started to work on the project, it was already at an advanced stage, thus setting the study in a peculiar context. Decisions and design choices had already been taken regarding the new diagnostic tool - leaving little room for local adaptations. The goal was to create a single diagnostic tool for all the car manufacturer garages all over the world. To sum up: one tool to rule them all.

As the tool was meant to match any context, country and culture worldwide, the \_unknowns team needed to design an international study to uncover both common grounds and differences in car diagnostic, as well as the usages of the current tool. The team opted

for a comparative approach. The countries were chosen as a consensus between scientific interests, business priorities and project constraints, as it was mundanely limited in time and budget. The idea was to use the garages as samples to capture as much diversity as possible in terms of cultural contexts, organizational structures and market sizes - within, of course, a given budget and a set timeframe. Ultimately, the decision was made to carry out the fieldwork in 17 garages spread out onto 5 countries: France, UK, Germany, Brazil and South Korea.

## **/ Field Strategy**

Given the complexity and the high level of expertise required, rushing headlong into a garage would have resulted in leaving ethnographers and designers stuck, confused by the flood of technical terms and gestures. To avoid the pitfall, the research started with an immersion and training phase to ramp up the team's knowledge about mechanics and tools used in the garages. The fieldwork was conducted within two sequences. The team started with an exploratory research in France to surface first findings that would then be compared with those uncovered in the other countries. The second part was to go all-out, worldwide - the clock was ticking. Backed by the field experience in France, the international fieldwork was carried out in the 4 other countries simultaneously, to confirm, challenge and enrich previous findings. That research strategy aimed at balancing the project's constraints with the most robust and rigorous fieldwork possible, in order to identify patterns and insight to redesign a global diagnostic tool.

## **/ Directing an International Field Study**

Given the cultural specificities that were taken into account when framing the research, the team decided to rely on local ethnographers, as it was necessary to take cultural variables into consideration from the start. Therefore, the research framework and study protocol was shared with the local partners as soon as it was designed, in order to make marginal adjustments. It was crucial to share the knowledge acquired by the \_unknowns research team during the immersion and training phase. In order to bring the local researchers up to speed with the topic, the team provided them with a complete briefing, involving custom-made books, videos and remote work sessions. They needed to be sure that no questions had been left unresolved. To further ensure local researchers were in the best possible set-up to conduct the fieldwork, each of them was paired up with a member of the research team. The coaching and support was also ensured through close communication such as daily briefing from start to finish.

## **/ Building the Research Framework**

To understand the usage of the diagnostic tool, and more generally the logic of diagnosing, the team had to take a step back to grasp garages and mechanics in a broader perspective. They focused on three main aspects to direct the study:

1. Mechanics and their job. The team's goal was to study mechanics as a profession (Abbott 1988), investigating its culture, core competencies, jurisdiction and internal structure in the workplace. What were the different roles and positions that mechanics played within the garage, what were the official and tacit hierarchies that may have existed, etc.
2. The environment, i.e. the garage as a stage on which the action takes place. Since the mechanics' everyday work took place in a specific environment, the team needed to study the garage organization, its objectives, its rules, and how they affected the repairing process and the tool usage. The works from the organizations theory field<sup>2</sup> were used to help frame the study and analyze the findings.
3. The diagnostic tool. An emphasis was placed on observing how the diagnostic tool was used and combined along with other resources. From an Actor Network Theory perspective (Latour & Woolgar 1979, Callon 1986), a special focus was put on how workers juggle the different resources available to achieve their goals.

The main research techniques were direct observations and informal interviews with mechanics and other workers in the garage. In each garage, the researchers were usually introduced to the staff by a senior mechanic, and stayed for 2 or 3 days long. The methodology employed was basic, from observing gestures to discussing them. The idea was to observe cases of car failures: ask the mechanic if it was possible to stay with him during his task, and if so, record all the gestures and all the steps, going from errors or doubts to victories. The researchers had created research field books to facilitate observations. The conversation generally slipped to broader aspects of the job: memorable past cases, life in the garage as a mechanic, career desires and personal thoughts on the way the job had evolved since they began to work. Shifting from direct observations to informal interviews was a good way to gather valuable material for the research.

But let's go back a little. Having built a research protocol and agreed on a comparative approach for the study, the researchers were set to go. Problem: they weren't mechanics. At all. To integrate themselves and mingle, they needed to get their hands dirty.

## **DIVING (DEEP) INTO THE GARAGE: FIRST ATTEMPTS INTO BLENDING IN**

Step one of the immersion phase involved getting the engine starting – literally. The team had a DIY “build-your-own-plastic-car-engine” shipped to their Paris office. Having the type of toy you might offer your nephew or niece for their birthday might seem surprising (well, to their colleagues it surely did), yet the exercise turned out to be extremely useful. First, for the vocabulary – and consequently the legitimacy. Also, and mostly, to get into the logic of mechanics: understanding the engine's system as a whole, with all its internal links and dependencies. If the plastic engine isn't starting, check if the piston is connected to the crankshaft by a connected rod. They don't lie, you always learn better by doing.

Step two was an official training on the diagnostic tool. The team integrated two different student groups and mingled with the mechanics for a short back-to-school session. In the mornings, dedicated to theory, students scrupulously followed the leaflets they were given – inside, pages of screenshots, functionality descriptions and methods on how to

interpret the data. It was already clear: being a mechanic today demanded digital skills. And, for some tasks, it seemed, less and less wit: guided diagnostics, for example, were accessible within the tool and simply guided users into step-by-step actions, thus normalizing practices and processes. As one of the trainers would later conclude: *“with guided diagnostic, give the tool to a hairdresser, and he’ll find the cause of the failure”*. Could any hairdresser really fix a car? Too soon to say - yet it already highlighted how progressive automation was offending mechanics by making some of their core competencies obsolete. For those well-experienced students, diagnosing and repairing had already been meaning researching data and interpreting it for quite a while. Electromechanics had been using voltmeters and ohmmeters for decades. But what could once have seemed logical to them now became confusing with the tool: instead of searching, thinking, and eventually understanding, the tool forced them into finding information and methods spread out across a network of websites and digital tools. But mechanics weren’t techs. And telling them that anyone could now do their job, questioning the legitimacy of those who didn’t find navigating the tool that simple, probably wasn’t the most instructive way to help them take the shift faced by their profession.

Step three was, finally, the big jump into the garage - or rather, a glimpse into what it looked like on the other side. Some first simple observations could be made. Geographically, the division was clear: between the administrative offices, the parts shop, the body shop, the mechanical repairing zone, and the electrical one. Each sector seemed to have its own role. Mechanics and electromechanics<sup>3</sup> had distinct tasks – and the former obviously seemed to get dirtier than the latter. Pieces of clothing could attest: senior electromechanics wore white blouses, while others mechanics wore darker ones. It turned out that the white blouses were worn by Technical Coordinators, aka the garage’s experts. Not so surprising after all that their blouses were as white as those of a doctor. It also turned out that those Technical Coordinators were the only ones able to use the diagnostic tool – officially, at least, as they were the only ones who were given a token to activate it. How was that supposed to work out, having only two or three people allowed to use the diagnostic tool? Again – theory.

The researchers got to witness the diagnostic tool in action on a defective radio. The Technical Coordinator in charge first seemed to be struggling while navigating through the different functionalities - not such of a digital-native it seemed. After having tried out a guided repair method, he decided to contact the technical hotline via another one of the manufacturer’s website. The technical hotline appeared to be yet another piece of the hierarchy: a group of experienced mechanics you could contact via a platform linked to the diagnostic tool to get help on a diagnostic or repair you couldn’t figure out by yourself. It wasn’t getting simpler. Hierarchy already appeared to be an intertwined chaos and the team could already guess some of its consequences, both on the internal organization and the use of the diagnostic tool. Yet it was only the beginning...

## **“LE MÉCANICIEN, LE GARAGE, ET LA TWINGO”: FRANCE FINDINGS**

### **/ Living the Garage Life: Repairing Under the Influence**

When a client brings a vehicle into a garage, he leaves it to a receptionist, along with some basic information filled up on paper forms. That information is used to look for

another crucial one: warranty. If the client's vehicle is still covered by warranty, the manufacturer will cover for expenses, but only according to a strict list of tasks to be performed under a maximum labor time and following specific diagnostic and repairing processes (they check!). But, if it isn't covered, all expenses will be billed to the client... and, you know it, expenses can quickly add up. But garages tend to be flexible - they still want to keep decent client satisfaction scores, which results in what Matthew B. Crawford calls a "moral tension (...) between a mechanic's metaphysical responsibility to the machine and his fiduciary responsibility to its owner" (Crawford 2009, 141). It was common to hear stories of days spent diagnosing cars that weren't under warranty anymore - and finally only billing a tenth of the time that had actually been spent. Obviously, achieving fast diagnostics and repairs is critical for the garages' profitability - a consideration that weighs on mechanics' shoulders.

### **/ Living the Garage Life: Productivity Pressure In an Uncertain Environment**

When assigned to a vehicle, mechanics usually have only little information - the information is passed on from the receptionist. Most of the times, it is barely enough to understand what is wrong with the vehicle. Mechanics might need to call the client back to get more details on the vehicle's symptoms. They might need to check the ECU's version and update them before starting any diagnostic operations. They might need to test-drive the car, or proceed to minor fixing to better characterize the symptoms. They also might have to wait for confirmation from the technical hotline or for spare parts to be delivered.

All those operations result in a fragmented and unpredictable process involving many operations, workers, and tools. Cars can't be fixed in one go. And, not only are mechanics having to handle constant back-and-forth operations on a vehicle, they also have to juggle with handling other cars and dealing with administrative work at the same time. It's non-stop communication with the warranty department, providing pictures of broken parts or screenshots of the diagnostic tool showing abnormal values. An efficient mechanic appears to be not only literate in mechanics but also able to make his way through the car manufacturer procedures. And all that, in minimum time. Call it impossible? Alex, a mechanics in Chalon-sur-Saône, described: *"I'm the only one with experience here, but nobody is in charge of the production planning. So as soon as a car arrives, I get one more file on my stack, in addition to the repairs I have to do, knowing that I should also make warranty agreement requests. And then I am asked to be productive!"*

### **/ Living the Garage Life: On Tricks, Tips, and Experience**

To streamline the workflow and to normalize diagnoses and repairs, the manufacturer's engineering department has set up a series of rules and methods to diagnose, confirm diagnostics, and repair. But most of them seem out of touch with the real garage world. Ed, a 10-year experienced senior mechanics in Le Mans, presented one to the research team: *"It's a method to control the starter (...) 'Activate the starter'. Look! Look! It doesn't make you start the vehicle, it makes you launch a start sequence. So if you do as he tells you, you cut off the fuel supply. It's not going to start because there will be no fuel. So this step, we're not going to do it because it's fucked up! Yeah, it's shitty to reactivate it... In fact, it gives you a method to control the starter alone. The easiest way is to try to start the car, if it starts you've saved yourself a good half an hour."* He had developed ways to bypass the non-

functioning readymade methods - he could, because he had a deep understanding of each underlying system inside the car. Thanks to experience, he knew exactly which methods would lead to dead-ends, and how to wisely use the diagnostic tool. Knowing those tricks and tips made mechanics more productive - by, ironically, working against the methods that the manufacturer had precisely set up to enhance productivity. Only highly-experienced mechanics could have accumulated the knowledge, which placed them as masterminds, at the center of the garages. The essence of being a mechanic also meant sharing and passing knowledge on - which is what we'll see in the next findings.

### **/ “I, Mechanic”: Building Certainties in Adversity, Or the Art of Diagnosing**

Observing mechanics performing diagnostics for days made it obvious to the research team: diagnosing car failures was more of an art than a deterministic science. It couldn't be reduced to a process or a set of rules. In their day-to-day work, mechanics seem to have a loose relationship with the official diagnostic rules provided by the car manufacturer: they know when to follow them scrupulously and when to ignore them.<sup>4</sup> Yet, such creativity is demanding, requiring both knowledge and experience - what Matthew Crawford calls the “cognitive demands of manual work”. Diagnosing is a process of identifying and fixing a failure in a system. It consists in iteratively building certainties on symptoms, causes and solutions, which is why we could compare mechanics to doctors in constant trial. When facing a car failure, a mechanic has to juggle different hypothesis. Fred, a mechanic in Le Mans, told the team about an old touring car: *“The engine is making a strange noise, it seems to run on 3 cylinders; I'll change the spark plugs to see if there's not a dead one”*. Was it a dead spark plug or a bigger problem? For Fred, it was the most frequent cause to check before going any further. As Crawford pointed out, mechanics *“come up with an imagined train of causes for manifest symptoms and judge their likelihood before tearing anything down”* (Crawford 2009, 35).

The diagnostic process isn't linear. New options can be tested and certainties questioned until there are no left. A good mechanic isn't one who follows the standard procedures - it is one clever enough to imagine what the most likely causes are, and to confirm the hypothesis without risking fatal mistakes. And, to succeed, mechanics have three kinds of resources: experience, understanding of a given system, and pair's knowledge.

### **/ Aim to Rule and Being Ruled: Destiny of a Diagnostic Tool**

As observed among the garages, the current version of the diagnostic tool has pushed automation to a pinnacle. Not only does it read and display faults recorded inside the cars' ECUs - it also invites users to apply solutions directly without understanding the real car's failure causes. By doing so, it postulates the existence of absolute breakdowns, abstracted from concrete situations - but, of course, there are no such things in real life. It is a complete denial of the intellectual work of mechanics, forcing them into a submissive position. And mostly, a lack of consideration leading to incomprehension, time loss, and frustration when in use.

The tool doesn't actually diagnose by itself: mastering a diagnostic still requires to use a lot of documentation, diagrams and other tools. And, when facing a mystery failure, mechanics could always find a simple solution: going back to basics. Each garage has its “mechanic library”: a room where old technical manuals are stored. Reading this literature

was always of good help - as new systems are often built on the same principles as the older ones.

Depending on which kind of breakdown, bypassing the tool could be a very common practice in most of the garages. Experienced mechanics tend to avoid the guided diagnostics and other generic procedures - they rely on their experience, senses, and understanding of systems. Fred, from Le Mans, was still diagnosing with his eardrums: *"Did you hear the sound it makes? This is a pot that leaks [...] there's no need to plug the tool, it's obvious, we just need to look underneath to be sure... and then it's purely mechanical, the tool wouldn't necessarily have raised any faults"*. Mastering the tool allows the mechanics to find shortcuts and hacks in order to work better. For example, the research team observed strategic uses of the guided diagnostics, such as mechanics diverting their initial function (i.e. diagnosing cars) and using them to access specifics actuators they couldn't otherwise. Finally, printing (a method, a diagram, reference values, technical notes etc.) is always a good way to gain efficiency in diagnosing and preventing the never-ending back-and-forths imposed by the tool.

As the diagnostic tool has progressively become an interface between the manufacturer and the mechanics - not only to allow diagnosing, but to impose repairing processes, administrative work and sales objectives - mastering the tool increasingly means mastering the organization. The ability to know when to act with and when to act against the tool thus defines what a good mechanic is.

## **"OPENING" THE RESEARCH INTERNATIONALLY: WHERE WE SEE PATTERNS IN AGENCY**

### **/ Living the Garage Life, Worldwide: Diagnosing in Scarcity**

Outside France, it appeared that both experienced mechanics and diagnostic tools were rare commodities. The official rule stating that only Technical Coordinators were the only ones authorized to work with the diagnostic tool was inevitably smashed into pieces: everyone actually used it. And the dependency on masterminds is even more critical internationally. From Curitiba in Brazil to Seoul in South Korea, garages offer a myriad of ingenious ways to deal with multiple constraints. Patterns emerged in organizational solutions invented locally. As observed, Technical Coordinators aren't only masterminds, they are also facilitators (used to streamline the work and organize the garage's workload), and experts (or "flying doctors" passing from car to car to help).

Along with a tremendous role given to most-experienced mechanics, other types of informal organization were observed:

1. **Pairing rookies with experienced mechanics.** It is common in Korea to team up highly experienced mechanics with young and less experienced ones, so the latter could benefit from the accumulated knowledge and experience of the first. The same practices were observed in Germany and at another level in France where apprentices are always supervised by a Technical Coordinator.



Figure 1. A mechanic discussing a case with a Technical Coordinator in Germany © Guillaume Montagu

2. **The “ask-for-help” rule.** A pragmatic rule usually set up in big garages where disparity levels existed within the team. When mechanics are stuck, they immediately ask for the help of a more-experienced mechanic. This rule is particularly institutionalized in South Korea where workers have a strong sense of hierarchy and where the group prevails over the individuals.



Figure 2. A Technical Coordinator helping a mechanic on his vehicle in Brazil © Guillaume Montagu



3. **Weekly work rituals.** In big garages, Technical Coordinators hold weekly meetings to share the cars cases they had to deal with recently, as well as information and updates on procedures, new models etc. This is also particularly institutionalized in South Korea where workers had a rotation system in roles, allowing every mechanic to be in position of gathering and sharing information to his section.



Figure 3. Technical Coordinators in South Korea, discussing complex cases during a weekly meeting © Chloé Huie Brickert

4. **The informal technical hotline.** Scarcity also applies to the regional technical hotline: in South America, there are only 5 hotliners to answer the whole continent! It results in close informal communication modes to avoid having to start a heavy procedure. This kind of informal communication before submitting request within the official system was also seen in France, not with the technical hotline but with network experts.

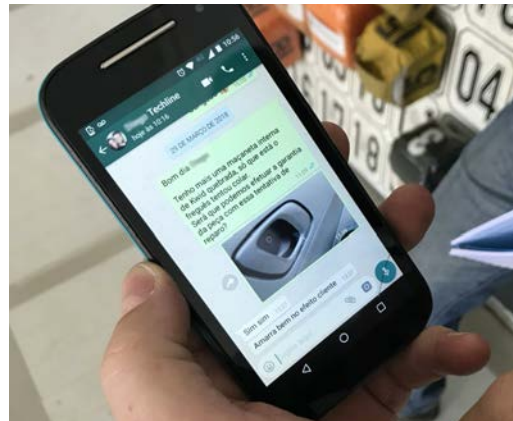


Figure 4. A WhatsApp conversation between a mechanic and one of Brazil's hotliner © Guillaume Montagu

5. **Private mutual assistance groups.** Experienced mechanics also rely on their private network of colleagues in other garages. Those kinds of networks are used to share information, ask for advice, or confirm hypothesis. It was common to see mechanics chatting over the phone with colleagues in other garages. As there are very few Technical Coordinators in South Korea, they all shared a private group on KakaoTalk (the local Messenger) to share knowledge on a national level.



Figure 5. A post shared within the Technical Coordinators' KakaoTalk group in South Korea © Pierre Joo

The scarcity of qualified workers and tools forces the mechanics to find other ways to work efficiently. Given the constraints system of the garages, a major part of their activity consists in managing risks: those related to the manufacturer (objectives and processes), those related to the lack of knowledgeable and experienced mechanics, and those related to the methods and tools.

### / Using the Diagnostic Tool, Worldwide: The Mechanics' Russian Roulette

Mechanics all over the world seem to experience the same limits and challenges with the diagnostic tool, as pointed out within the France fieldwork. It wasn't considered as reliable and trustworthy, but more like a prerequisite to perform certain tasks (like updating or reprogramming ECUs) or to interact with the car manufacturer.

Besides, the scarcity of qualified workers and tools makes time loss even riskier: using the tool means running the risk of making mistakes or, even worse, of losing data, time, and money. Working with the tool always required a strategy and backup plans in case things went wrong. For instance, the fear of losing data due to the absence of feedback or confirmation messages during critical operation (like ECUs reprogramming) made mechanics cautious - or worse, anxious: *"There's no confirmation that data has been saved onto the tool. It's like working blind. (...) Sometimes when swapping computers I have to save the data to write it back into the car later, if I'm working on a car for two days... the tool might be passed around in the workshop and the data might get lost. Even some updates delete data."* said Jim, Technical Coordinator in Cardiff's garage in the UK.

Updating the diagnostic tool's software is always a critical moment, with a high risk of blocking it until a corrective patch is released - which would incapacitate the garage for days, with no compensation from the manufacturer. Thus, tool updating strategies are set up to prevent any problems. For example, garages equipped with more than one diagnostic tool would use one as a guinea pig to test the update: there would be one left if it fails. In that

context, the ask-for-help rule also prevented mistakes within the tool, as it acted as a safeguard to avoid time loss. Günther, a German mechanic: “I had to see Karl (the Technical Coordinator) in order to ask what to do next, as the tool read an error. He told me to start the car and the tool all over and to repeat the process. This kind of work isn't counted as labor time by [the manufacturer].”

The power struggle between the garages and the manufacturer, which imposes a deficient yet prescriptive tool, as well as arbitrary processes, was key to understanding how mechanics define themselves and what their *raison d'être* is: their shared culture.

## **/ The Universal Underground Culture of the Mechanics**

The international fieldwork highlighted what the researchers called the *mechanics underground culture*. Observing day-to-day routines from one side of the planet to another made it clear that many experiences and values were common to all of them. Various and widely spread forms of workarounds are developed by mechanics to overcome tool flaws and organization rules. Mechanics' ingenuity relies both on diagnosing and repairing (how they mastered the art of diagnosing), and on making a way through the manufacturer's organization. This kind of knowledge and of *secondary adaptations* (Goffman 1961) are precious resources and strategies - allowing mechanics to build up to their “metaphysical responsibility to the machine” (Crawford 2009) and to preserve an acceptable and noble definition of themselves. This culture was built *with* and *against* the manufacturer's organization, and the struggle had its battlefields (diagnosing, repairing, interacting with the manufacturer's departments), its opponents (mechanics vs. the organization and specifically the warranty department) and its allies (other mechanics). As Andrew Abbott pointed out, a profession exists in itself when it achieves to maintain a “strategic heartland monopoly” over a core jurisdiction (Abbott 1988) - and competing for the monopoly of diagnostic is at the heart of a mechanic's job.

The mechanics' way of defining and performing their job evolved in reaction to the car's technological changes and car diagnostic tool automation. Automated systems challenged mechanics in their *strategic heartland monopoly* (Abbott 1988), yet only with little results - mechanics fighting back with bypasses, hacks and workarounds in order to successfully repair cars.

Thus, finding agency in the context of technical uncertainty became part of the tricks of the mechanic trade: it contributed in defining what makes a good mechanic and what doesn't. And a good mechanic is definitely one who can find and keep agency in his work.

For the researchers, being able to observe and to access the mechanics' agency within the garage and within the organization of that particular manufacturer was the warranty to deliver efficient recommendations for the tool - which is what we'll present in our last part.

## **WHERE AGENCY INSPIRES DESIGN: TOWARDS A NEW DIAGNOSTIC TOOL**

### **/ From Observing Agency to Recommending Digital Functionalities**

There is no such thing as pure agency - to be observed and understood, it must be repositioned within its context. And, to do so, researchers have to be sure to set up the right

environment. The protocol had set observations and interviews - but, by the time they actually got to the garage, researchers transformed the face-to-face interviews to “side-by-side” ones. They simply took the mechanics’ routines into account: they didn’t have time to sit down and have a nice little chat - mostly, they wouldn’t have felt at ease. The researchers preferred putting themselves into the shoes of the mechanics - literally, by wearing the same security boots. They followed them during their work days and questioned them about their tasks while they were performing them, rather than having them sit down in a room and theorize about their jobs. Gaining sympathy and trust is a long process. But time does well – and it did. Although the researchers’ schedule was tight, they still managed to stay at least two or three days in each garage. One rule: talk to everyone, from the most junior to the most experienced mechanic. Don’t restrain to work hours: lunch breaks are good too - if not better. Keeping an empathic posture was necessary and seemed natural to understand the mechanics’ own points-of-view.

Allowing researchers to share the life of the garage and to witness their diagnoses and repairs was the best mechanics could do. UX solutions and recommendations came naturally, escaping from real-life situations to be put back within digital functionalities. Most features concerned knowledge management, as agency in the garage mostly translated into learning and transmitting. Although forced into processes and readymade methods, and constrained by a diagnostic tool, mechanics always found their way into finding the right solution, may it involve another mechanic, the whole garage, the next door garage, the technical hotline, or even another experienced mechanic at the other side of the country. To translate agency into digital functionalities, researchers took into account side routines, bypasses (both on the diagnostic tool and on the processes), and all further initiatives. The team illustrated the solutions in a schematic sketched interface, as shown below on three examples.<sup>5</sup>

## **1. Multiwindow interface**

In all 5 countries of the study, the researchers had observed an enormous amount of printed information – methods, numbers, graphs. As the current diagnostic tool’s computer had a small screen, and that following methods meant opening new websites and pages on the tool’s desktop, it made it difficult to have an overview of all the information needed. Printing, screenshooting, and DIY-ing multiple screens with sheets of paper and cellphones was a basic practice within the garage. Creating a digital multiwindow option was a way to ease the research among all kind of information, allowing users to create their own dashboard and modifying it from one case to another – sometimes using electric diagrams, electrical values, fault codes, some others using reference values and repairing methods. With the multiwindow feature, the diagnostic process was let “free”, while equipping the users with what *they* thought was useful in their case. And, last but not least – it would make the garage (almost) print-free!

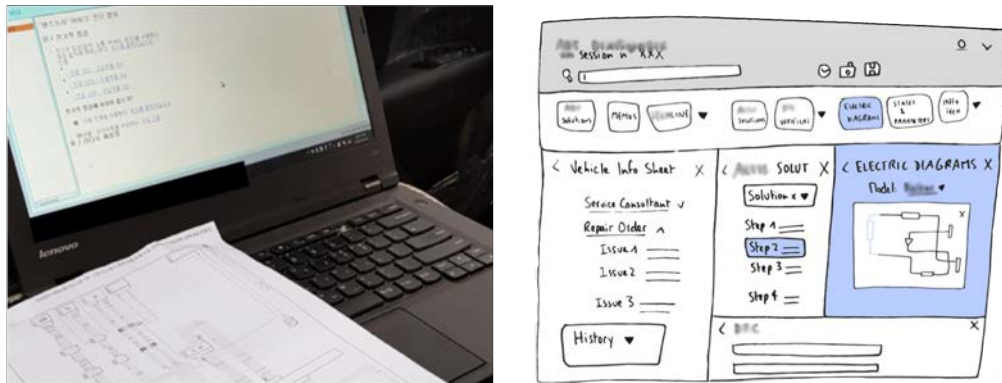


Figure 5. A printed diagram used to follow a repair method in South Korea (Left, © Pierre Joo) and the multi-window interface it inspired (Right, © unknowns and Renault)

## 2. Information pinning

Along with the previous solution, being able to “pin” values and information while testing some features on the vehicles came naturally when observing informal practices within the garages. When starting a car engine or turning on the AC, a functionality within the current diagnostic tool allowed mechanics to observe values and their evolution – yet, without doing anything with it. Again, by screenshotting, printing, writing down, the users managed to create ways to save the values and the information, but the loss of time and frustration were substantial. Having to go from one information to another, on different mediums, and without having an overview added another task to the long task lists. The pinning functionality would allow users to “pin” values and information on the dashboard and see them evolve while doing tests on the car.

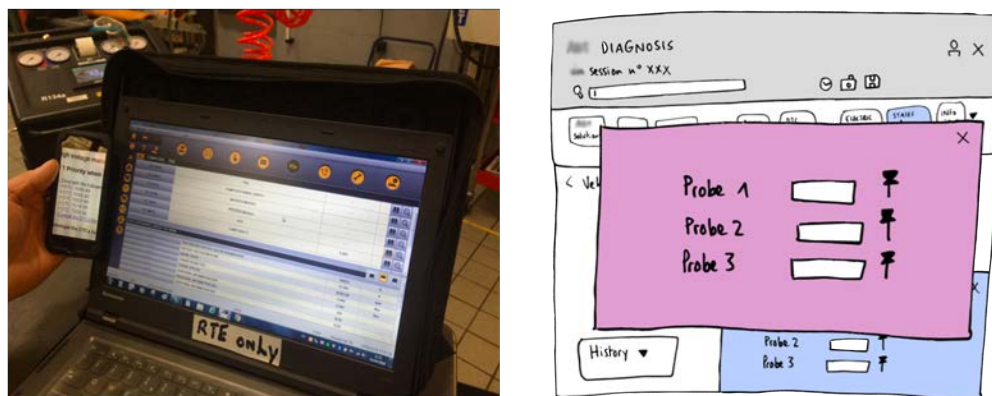


Figure 6. A cellphone used as a second screen to know which fault codes to watch in the UK (Left, © Chloé Huie Brickert), and the pinning functionality it inspired (Right, © unknowns and Renault)

### 3. Keeping notes & memos

Many solutions aren't contained in readymade methods. And, when readymade solutions don't work, mechanics must find ways to overstep them. Meaning digging deeper, sometimes causing other issues to understand the links and the intertwines. It sometimes involves three, four, five, six or more people. And yet, there is no way to keep track of what has been done. Mechanics do have their tips and tricks to keep track of methods – notebooks, pieces of paper, WhatsApp conversations. But no formal tracking is kept of those miraculous and sometimes complicated repair processes. The solution recommended here was to create a “memo” option included on the dashboard. The mechanics are let free to save, or not, their solution by writing what they have done to diagnostic and repair the failure. They would then be able to go back to their memos if a similar case occurred again. They could also decide to share the memo, either with one person, one garage, or the whole network, encouraging knowledge management and sharing.



Figure 7. A mechanic's notebook in a French garage, collecting all complex failures and solutions (Left, © Chloé Huie Brickert), and the memo functionality it inspired (Right, © unknowns and Renault)

The design recommendations were clearly inspired by agency, as all solutions directly came from the mechanics themselves. But it didn't mean taking agency back from them - it meant empowering them, as the solutions would allow them to learn better and go faster, at least on basic tasks. Mechanics would always have agency - after all, they were smarter than the diagnostic tool.

### / Design & Its Limits

As progressive automation and technical uncertainty had increased tensions between manufacturers and their mechanics, the latter felt a lack of consideration and needed to know that they weren't going to be replaced by the vehicles themselves. Mechanics careers weren't as attractive as they used to be, as the idea of what the job meant became unclear. Trainings were evolving as well, without necessarily meeting the requirements of new vehicles. Recruitment and turnover was thus becoming a hot issue for the manufacturer.



They had to retain its mechanics and train them into technicians, following the evolution of cars.

The redesign of the diagnostic tool thus came as a way to ease the tense relations on two levels, both *symbolically* and *practically*. The study itself was a way to show the mechanics that the manufacturer cared for them and about them – they were worth learning from. The tool would then be an end in itself: if it took into consideration the needs of its users and made their day-to-day job easier while escorting them towards a more digital aspect of their job, it would carry a strong message from the top management. And, as the tool was at the crossroads of three main departments (the warranty, the technical hotline and the aftersales engineering), the symbolics were even stronger, as, if well done, it could put the mechanics back at the center of the organization. Redesigning a work tool always has more at stake than it first states. But does it always have a bigger impact?

Along with the study, the design and prototyping process had set to involve mechanics along the way. As the design of the new prototype was being fed with the insights brought by the researchers, it was progressively tested by groups of Technical Coordinators and electromechanics, to then be adapted with their impressions. The project was progressively building a worker-organization interface, finally allowing workers to speak out. But empathy and co-design processes always have their limits. The project was still... a project. With deadlines, political issues, feasibility limits. First of all, it couldn't involve all the mechanics and all the garages, as logical as it might seem. How many issues weren't addressed? Then, it wasn't able to integrate all the recommended functionalities - compromise must always be found. What was the outcome of the project going to be? - the researchers wondered. Would the mechanics see their work evolve positively along with the new tool? While a first version of the new tool has just been released, all these questions remain open.

Conducting studies is necessary to understand one's organization environment. Having independent consultants execute them can be a good idea. But consulting has its limits as well. Having independent researchers do the job doesn't spread the same message than having company executives visit workplaces themselves. Moreover, not even having to launch the execution of a study: visiting garages regularly enough to understand their functioning, and carrying that knowledge onto all projects. Again, the organization itself comes as a limit. There are power dynamics, some you can (re)balance, and most you can't.

## **DISCUSSION: ON AUTOMATION AND THE FUTURE OF MECHANICS**

The design challenge faced by the researchers went beyond recommending functionalities for the mechanics' work tool, as we've seen. It wasn't only about the diagnostic, it was about the diagnostic *in an automotive context*. It wasn't only about introducing a philosophical shift in the manufacturer's relationship with its employees, it was about introducing a philosophical shift *within an automotive context*. As the researchers discovered along with the study, their responsibility was also involved into (re)considering the role of artificial intelligence and automation – how it would affect the mechanics, and how technology would complement their job rather than replace it.

To the manufacturer, automation is a way to have more efficient vehicles - more intelligent vehicles that could, eventually, diagnose themselves. On the client's side, the vehicle dashboard, with more and more information, indicates him what is wrong before

even making it to the garage. In theory. On the mechanics' side, some software programming would be done automatically. Fault codes would appear when plugging in the diagnostic tool: if they were red, it meant trouble - but the manufacturer's engineers had created guided diagnostics and guided repairs to facilitate the work on the electrical parts of the vehicles. Again, in theory. Progressive automation intended to make the machine learn from its failures and improve self-diagnostic and predictivity. But machines don't learn by themselves. They must be fed. AI must be taught. And who better than the mechanics to teach them.

The strategy of the manufacturer's engineers had been to normalize methods, but those engineers can't predict all failures and plan all methods. Machines can't either. And, the other way around, all methods can't be applied and miraculously repair car failures. Because, in the real world, there are surprises, things don't always work out well, and still - we still manage, eventually, to take decisions and find solutions. In the garage, it might involve the next-door mechanic, the next-door garage, or even the across-the-country one. But still - they manage, and they learn. We've talked about tacit knowledge at the beginning of this paper - here it is, again. Computers don't have the same tacit knowledge as humans: they don't learn to read a book or to ride a bike as we do. Failures aren't always predictable - they require time, energy, and team work to be resolved. The kind of work that computers can't do. At least, not yet. The only thing computers require is a feedback loop. And that loop can be powered by mechanics. The researchers therefore suggested one last functionality that would close up the diagnostic tool session on a vehicle.

### **/ Logging the Solution: Feeding the Machine**

To allow the machine to learn from past cases, it has to be fed. Some informal processes had already been enforced in some of the garages. In a garage in Cardiff UK, a sheet of paper with three lines were filled by mechanics in charge of the vehicles: "symptom - cause - solution". One of the last solutions presented here by the researchers was to add a functionality at the end of the repair process. Before the mechanics saved what would have been done on the vehicle with the diagnostic tool, the tool would ask one last question: the same "symptom - cause - solution" trio. Again, what they used to do manually could be digitalized and serve to better manage knowledge.



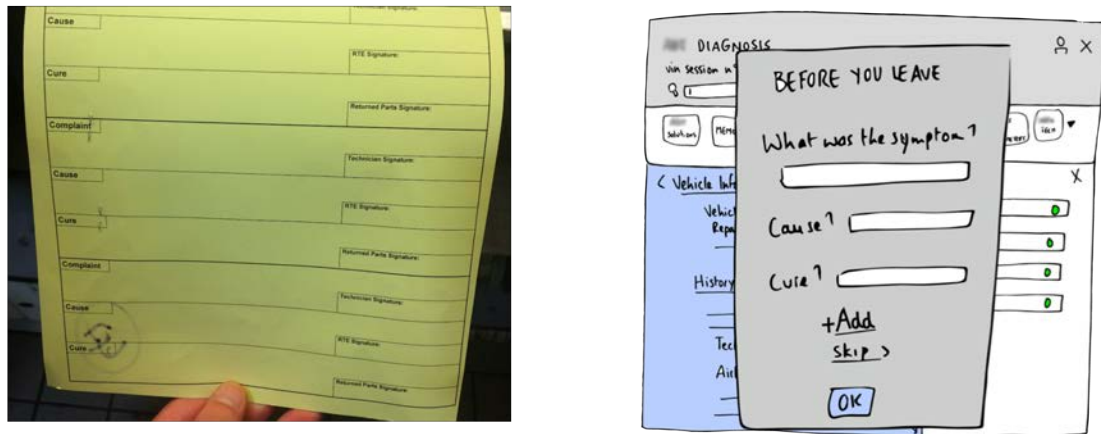


Figure 8. A vehicle information sheet as used and filled out by mechanics in the UK (Left, © Chloé Huie Brickert), and the solutions login functionality it inspired (Right, © unknowns and Renault)

Such solutions were the kinds empowering the mechanics by acknowledging that they were proper *technicians* and *researchers* rather than methods-appliers. Which didn't mean that they wouldn't apply the methods that had been created. It was a philosophical shift, yet not a total transformation. The manufacturer would still be in control of the functioning of aftersales – mechanics would still have to prove warranty of what had been done on the vehicle, as well as ask the technical hotline for help and for parts authorization.

But the mechanics would find in the tool provided by the manufacturer an aid and not an impediment. They would be in control of their job evolution: they *could* follow methods, but they could also experiment. As vehicles would get more and more complex, automation could progressively be attained on the easiest failures – letting mechanics work on most complex ones. And again, it was in the manufacturer's interest to help mechanics become technicians. Companies can't survive without engaged employees - and cars can't survive without intelligent and trained humans.

**Chloé Huie Brickert** is a UX Designer at \_unknowns, a business & innovation consultancy (Paris, France). She is a fast & curious mind with a rich cultural heritage, passionate about understanding humans and designing truly helpful solutions. As a sharp observer, she also sketches the world into her playful and insightful fanzine.

**Guillaume Montagu** is an Anthropologist at \_unknowns, a business & innovation consultancy (Paris, France). He is a Frenchman with style and an unstoppable eagerness to understand people and trades. A curiosity that makes him an esteemed anthropologist, a talented potter and the most knowledgeable man on French trains you'll ever meet.

## NOTES

1. Technical uncertainty refers to technologies that become more and more complex, thus “*inhibiting deep knowledge among users*” (Borg 2012)

2. Several works from this field were especially used (Allison 1971; Crozier 1963; Goffman 1961)
3. To facilitate the understanding of the case study, we won't distinguish Mechanics, Electromechanics and Technical coordinators, unless needed
4. *"Creativity is knowing what to do when the rules run out or there are no rules in the first place. It is what a good auto mechanic does after his computerized test equipment says the car's transmission is fine but the transmission continues to shift at the wrong engine speed"* (Levy, 2006).
5. One last functionality will be illustrated in the automation part.

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## Getting Us There

### Ride-Hailing Systems from the Drivers' Perspectives

KEITH S. KARN, *Human Factors in Context LLC*

WILLIAM E. HUTSON, *IBM*

*Now that they are beyond the initial start-up phase, it is time to take a critical look at ride-hailing systems such as Uber and Lyft. This ethnographic case study investigates these systems from the drivers' perspectives and also addresses the ethnographic techniques and general approach that we used. Without a protocol, budget or equipment, we interviewed approximately 150 Uber, Lyft, and Taxi drivers in 23 US cities over 2 years during paid rides. Our loosely structured interview approach allowed us to collect information from drivers regarding the entire gamut of their jobs. This included how and why drivers work, their choice of work hours, rider pickups, driving, vehicle ownership and maintenance, rider behavior, perceptions of safety / danger, navigation, general likes and dislikes of the system, and financial matters related to their business. Our findings cover a wide range of issues, some bearing on poorly designed or missing functionality in the driver's mobile apps, but also spanning social, emotional, financial, and behavioral issues that impact the drivers. These issues directly relate to decision making, worker autonomy, and human agency.*

#### INTRODUCTION: LOOKING BENEATH THE SURFACE

This case study focuses on ride-hailing systems (also known as *e-hail*, *ride-sourcing* or *transportation network companies*; see Shaheen & Cohen, 2018) from the drivers' perspectives. In addition, we start with a discussion of our general research approach, which we consider equally important to the findings.

Ethnographic techniques allow us to see more than what is on the surface, more than what we normally "pass by" in any particular setting. So many of us take advantage of these transportation services each day yet it is easy to miss what's really going on with the humans who are serving us. The ethnographic techniques help reveal the motives of actions of various players, for example the intentions of workers, surfacing not just the "how" of work but the "why" of work. These instruments of ethnographic research give us the means to learn how things are going in a particular environment, perhaps discovering gaps in the design of a range of systems, software applications, and even detect the rough edges in business models—old or new. This type of research can help us peer into situations and settings—learning about the unmet needs and wants of humans, their work struggles and what they love about their work. These techniques can even begin to surface bellwether indicators of systems that are in trouble.

In this paper we present a case study of the use of ethnographic techniques to investigate disruptive and evolving business innovations in mobile app-based ride-hailing systems from the drivers' perspectives. One unique feature of this case is our method of study, described below in detail. In brief, we conducted this study in a rather expeditionary manner, with no budget, while we were working on other projects.

## EXPEDITIONARY ETHNOGRAPHIC INQUIRY: A HABIT OF UNCONFINED DISCOVERY

In this atypical project, we had no client, no project plan, and no budget. This study was not even planned prior to its start, though we did become more intentional about our study as the project unfolded and as we learned more about the topic. We began the research informally, motivated purely by personal and professional curiosity and the desire to connect with the people who were providing our transportation, typically while on business travel for unrelated project work. To be clear, we are not employees of a ride-hailing company tasked to evaluate our company's services. We were not paid as consultants to investigate these transportation services. This work was not academic in nature (e.g., we had no grant funding, no pressure to publish, no team of graduate students analyzing data, etc.).

The vision for this project came from conversations (phone, email) between the two of us (the authors), about various topics related to our work in user research and system development. Since graduate school we both have adopted a habit of thinking about work, the design of workplaces and tools, and human workers, summarized as "always learning through observation and conversation." We both travel often for work and now frequently make use of ride-hailing services—a rather abrupt switch from rental cars in past business travel. So, it was natural that this topic of the ride-hailing services and the drivers surfaced in an exchange in which we compared our observations and decided to pursue the study more intentionally while on business travel with our "day jobs."

We were not paid for this study. We did not seek approval of an IRB, though we took precautions to safeguard the identities of our drivers and their personally identifiable information. We did not, for example, record audio or video of our conversations.

One central point about our approach which we would like to draw out explicitly is the "spirit of discovery" that fueled the present investigation. We chose to undertake discovery about one domain of human work as we went about our other work. This "always discovering" habit of mind, we believe, can be quite useful to ethnographers. For instance, it can enliven one's day, turning the hum-drum task of moving about a city into opportunities for professional discovery, as one seeks answers to questions about what is going on under the surface of ordinary events.

Second, this habit helps to keep us attentive and our skills of observation sharp; it can also generate solid design and methodological ideas along the way, perhaps useful for other projects and in other settings. Finally, this attentive spirit can greatly "humanize" one's day, allowing the engaged observer / interviewer to see "humans" operating in various settings, rather than simply passing by "organisms" or "instruments" serving us in various capacities. Without this spirit of attentiveness and study, people can become, sadly, just background noise. The "always discovering" spirit can thus counter such dehumanizing tendencies.

## OUR SUBJECT: UBER & LYFT IN ADOLESCENCE

Just as we measure the life of a dog in *dog years*, we consider mobile app-based ride-hailing companies—most notably Uber (launched in 2011) and Lyft (launched in 2012)—to be in their adolescence in *start-up years*. They are not the cute little infants and trendy toddlers they once were. It is that time where many are taking a good, hard look at them (acne and

all) and asking *where are they going*, and *what will they be when they grow up*? Although much has been written about the disruption of the traditional taxi industry by these ride-hailing systems, little is known regarding how these new mobility options affect the drivers, especially with respect to more substantial matters such as decision making, autonomy, and human agency.

The technology of these systems has made possible new ways to acquire transport services, but these innovations have correspondingly removed both the rider and driver from the decision and action loop for many aspects of the ride experience. Ride-hailing applications use complex routing and pairing algorithms to assign riders to drivers, weighing traffic patterns, vehicle size, seating requirements, and other preferences to satisfy a request initiated by a rider. Moreover, given the longer-term goal of transitioning to driverless vehicles in these systems (Newman, 2014), little attention seems to have been paid to drivers' perspectives (Angrist et al., 2017). To address this information gap, we examined the effects of these mobile app-based ride-hailing systems on the drivers, conducting observations and contextual interviews with drivers of Uber, Lyft, and taxi services.

In broader context, ride-hailing innovations, such as Uber and Lyft, are the fruits of a much larger disruptive development in the area of personal mobility underway in our society. For instance, in the last 20 years we have seen several mobility-related innovations, giving people new options to get around, including not just Uber and Lyft, but also short-term car rental (e.g., Zip Car), peer-to-peer car sharing (Shaheen, et al. 2009), bike sharing, e-scooters, and so forth. Options for personal mobility are on the rise.

We were interested in learning how ride-hailing innovations have affected the humans in the setting, not just the rider who benefits from these new choices, but more so, the drivers. Do drivers have a full and accurate view of the self-owned business, of their varied expenses? How hard is it for these drivers to get this view of their business? More broadly, what “ripples” or indicators were noticeable about these relatively new systems? Ripples can point to insights, and insights can point to design improvements. Aside from increasing consumer choice (and lowering the cost of rides), what are some of the unanticipated consequences of these innovations on both the rider and the driver? Finally, is the current state of ride-hailing options sustainable, or are there refinements needed in software and the supporting business models?

## **METHODS: SITTING UP FRONT**

What started out as casual observation in the field ended up as a three-fold, triangulating approach including:

- Informal, semi-structured, in-car interviews
- Post-hoc literature review
- Mining of rich and varied on-line discussion groups of drivers from Uber, Lyft and taxi services.

## **Minimally Invasive, In-Car Interviews**

After two years we had conducted more than 150 loosely structured, contextual interviews / observations while riding with Lyft, Uber and taxi drivers during paid rides in 23 US cities. The sample included approximately 70 Uber drivers, 50 Lyft drivers, 50 taxicab drivers, and 4 private car services drivers. Note that many of these drivers work for more than one company.

We generally would request to sit in the front passenger's seat whenever we rode in a ride-sharing vehicle in order to encourage exchange, minimize social distance, and build rapport with the driver. Out of respect for tradition, we typically did not request a front seat in taxi cabs except when traveling with a group, the size of which necessitated the use of the front seat.

As noted above, we did not record our conversations with the drivers so as to minimize disruption and restraint associated with the knowledge of being recorded. The nature of the topics did not call for the after-the-fact granularity which audio and video recordings provide. Generally, we did not even record notes on paper during rides. As a result, we were able to adopt a minimally invasive approach that allowed us to gather deep insights. We were open and honest about our intentions and expressed genuine interest in the drivers. As a result, drivers generally rewarded us with authentic opinions and rich insights.

The topics discussed were never formalized into a script, interview guide, or question list, and were largely determined by the natural flow of conversation, less choreographed and more extemporaneous. Topics spanned the gamut of the driver's jobs (both as drivers and in other trades and professions for those who also worked other jobs). Discussions often covered how and why drivers work; their choice of work hours; details about the procedure for passenger pickups (and choice allowed), driving tasks, issues related to vehicle ownership and maintenance, rider behavior (and drama) as seen from the driver's perspective, navigation tools and tasks, likes and dislikes regarding the drivers' app and the entire ecosystem, and financial matters related to their business.

## **Post-hoc Literature Review**

Due to the ad hoc nature of this project, we did not conduct a formal literature review before diving into our research. Instead, as the project began to take shape, we came across news and journal articles initially more by happenstance than from intentional search. Although this is not our typical approach to research, we were surprised to find a refreshing freedom in starting our data collection with a blank slate and then later reading the findings and ideas of other researchers.

We were also a bit surprised by how little published research we found on the behavioral and attitudinal aspects of the ride-hailing innovations of Uber and Lyft from the driver's perspective (e.g., hours worked, motivation, allegiance, app ease of use, sense of autonomy, etc.). This is not the case with respect to research centered on the economics and pricing strategies of these ride-hailing companies (summarized briefly below). Yet, there is a rich and growing set of thought-pieces and news articles about the impact of these innovations on drivers' behaviors and attitudes in various news channels and also within on-line discussion groups.

With respect to the economics of ride-hailing services, Salnikov, et al. (2015) compared fare pricing between taxis and UberX in New York City and found that taxis generally provided slightly less expensive fares. In a similar vein, Chen, et al. (2015) studied the surge-pricing algorithm used by Uber with a particular focus on transparency (to riders) and the effects of this algorithm on demand for rides. They caution that the current black-box approach to pricing may have unintended behavioral effects and could even lead to manipulation, pointing to anecdotal evidence that some Uber drivers—by exploiting differences between surge areas—have attempted to induce demand surges, artificially decreasing the supply of available cars for hire.

Lastly, on the theme of economics, Cramer and Krueger (2016) studied the capacity utilization rates between taxis and UberX drivers. They found UberX drivers had significantly higher rates of utilization (“higher share of miles with a passenger”) compared to taxi drivers. They attributed the difference to several factors, including Uber’s flexible labor supply, Uber’s driver-rider matching algorithms (including surge pricing), and some taxi regulations which effectively dampen utilization rates for taxis in aggregate.

Rounding out our literature review, we broadened our search for relevant literature beyond Uber- and Lyft-specific research in order to better understand several behavioral-related factors, such as safety, fatigue, and the health of paid-drivers. We also reviewed briefly the future of personal mobility, which will eventually include autonomous and semi-autonomous riding (“driverless cars”); these innovations will bring with them a great demand for substantial study by ethnographers.

The safety of taxi drivers has received, not surprisingly, considerable study over the years. Briefly, Dalziel and Soames (1997) analyzed a set of fatigue-related factors and accident involvement of taxi drivers over a two-year span. They found a significant negative correlation between total average break time and accident rate. Similarly, Lim and Chia (2015) studied taxi driver fatigue and health status (self-reports of hypertension, diabetes mellitus and high cholesterol). Reports of driver fatigue were found to be more associated with other work-life habits (e.g., poor quality of sleep, the holding of part-time jobs, long driving shifts (>10 hours of day) and the over-use of caffeinated drinks) than it was associated with health status, per se.

Future mobility solutions are already being well researched. Both Saffarian, et al. (2012) and Endsley (2017) examined various human factors aspects of autonomous and semi-autonomous driving systems (not specifically related to ride-hailing situations), including the importance of maintaining human situational awareness, out of the loop performance problems, loss of skill, mode errors and trust. Also, with respect to driver autonomy, Eriksson and Stanton (2017) studied transitions between automated driving and human controlled driving. In particular they studied control transition times needed under various driver task loadings.

## **On-line Discussion Groups**

We monitored and mined a rich and varied set of on-line, open discussion groups for drivers from Uber, Lyft and taxi services. Examples of these groups include:

- Uber: <https://uberpeople.net/>
- Lyft: <https://www.reddit.com/r/lyftdrivers/>
- NYC Taxi: <https://www.yellowcabnyc.com/>

- Ride Guru: <https://ride.guru/>

It is difficult to summarize the richness and depth of the driver information found at these ride-hailing sites; they are, in short, an inexhaustible stream of insights about the behavioral and business dynamics of ride hailing, mostly from a driver's perspective. For example, there is information on how to handle various situations using the software applications of different ride-hailing companies; there is information on how to deal with various rider problems (rudeness, threats, medical issues that occur during rides, impromptu requests from riders, rider safety, dealing with taxi drivers, etc.). On these sites, drivers also discuss strategies for optimizing fares (and minimizing hassles with riders), and there are various "how to" topics for calculating depreciation, profit, and car maintenance expenses. In short, nearly every subject imaginable, and many in substantial depth with broad contributions from the community of drivers.

Ethnographers interested in ride-hailing will benefit greatly from spending hours in these sites, immersing themselves in the hour-to-hour life of both driver and rider. In contrast to the field interviews we conducted, these sources provide driver input from a different angle, sometimes with greater depth, richness and color. For example, posts to these forums were much more likely to include complaints about specific passenger behaviors that did not come up during in-car discussions with drivers.

## **FINDINGS: DRIVER ED (DRIVERS EDUCATING RESEARCHERS)**

Drivers usually granted our requests to sit in the front seat—generally welcoming the more congenial atmosphere created by a side-by-side seating arrangement. With our minimally intrusive interview techniques, drivers were quite open and honest about their experiences and feelings related to their professional driving and its impact on all aspects of their lives including how and why drivers work, their choice of work hours, rider pickups, driving, vehicle ownership and maintenance, rider behavior, navigation, general likes and dislikes of the system, and financial matters related to their business. Our findings cover a wide range of issues, some bearing on poorly designed or missing functionality in the driver's mobile apps, but also spanning social, emotional, financial, and behavioral issues.

### **Our Drivers**

Ride sharing drivers are a diverse group. Any stereotype would be misleading. We encountered diversity in almost every dimension imaginable. We rode with retirees with a desire for "something to do" or extra cash, college students driving between classes, immigrants who were driving as their first job in the US, and a former high-ranking university officer who felt shunned by peers after the admissions scandal—just for some examples.

So, what did our drivers have in common?

- The drivers understood that their principal tasks and duties were centered around providing reliable and pleasant transportation to strangers with related duties of



keeping their vehicles in good working condition, clean, and tidy (with varying degrees of pride in their vehicles).

- They all seemed to appreciate the autonomy associated with deciding where (within constraints) and when they could work. They appreciated that they could set their own limits and goals for how much they worked.
- Drivers were aware at a high level of the financial pressures and tradeoffs related to driving (e.g., short-term expenses for gas and oil changes and short-term payout in pay and tips).
- The Lyft and Uber drivers generally did not think of this job as a “career” or a long-term commitment. This differed from some cab drivers who could see driving a cab as a longer-term job.
- A few drivers had started their own personal car services which allowed them to drive for a group of their own clients without a corporation and an app between them and their riders.
- Most younger drivers were generally reliant on their mobile phone / GPS-based maps for navigation. Only older, more experienced drivers (particularly cabbies) who started before GPS systems were prevalent, were adept at navigation without these aids.

Regarding the general outlook on app-based, ride-hailing systems there was a clear divide between those on the inside (i.e., Lyft and Uber drivers) and those outside the system (traditional cab drivers). The traditional cab drivers were predictably resentful of the new app-based ride-hailing systems that were undermining their business. Those who experienced the most loss were those who had invested in the purchase of a cab medallion, the value of which has dramatically fallen since the introduction of app-based ride-hailing systems.

## **Hours Worked**

Some drivers worked full time (i.e., 40 hours per week or more) while more used it as a part-time job or a supplement to another primary job / income. Drivers generally liked the freedom to choose their work hours with some choosing early morning shifts, some choosing late night shift, and many doing “splits” with work during peak activity during the morning commute and then again in the evening with a break midday.

Some drivers admitted that the lack of externally imposed structure on the workday sometimes made it hard to know when to quit. This paired with the company’s incentives to complete a specific number of rides in a day to earn a bonus sometimes resulted in drivers working longer than they had planned. In general, the systems tend to focus drivers on short-term goals, such as financial incentives to perform a certain number of rides within some fixed time period. Some drivers recognize this tradeoff and struggle to gain a longer-term perspective on work life.

Both Lyft and Uber now require their drivers to take a six-hour break from driving after the app detects prolonged periods of driving (14 hours with Lyft and 12 hours with Uber). That said, one app does not know when the other has been turned on, so some drivers

occasionally choose to drive longer by switching between apps (see “multi-apping” and app switching discussed below).

## **Driving Locations & Getting Home**

Most drivers appreciated the autonomy and agency provided by the means to work where they pleased. A surprising number of drivers commute long distances into more central metropolitan areas where demand for rides is higher.

Some appreciated the driver app’s indication of areas where drivers were in demand, however savvy drivers indicated that they have learned not to “chase the surge” as the demand has inevitably subsided by the time one transits to a *hotspot*. Instead, these drivers learn from patterns in such information and internally anticipate the increase in demand based on predictable or periodic events such as rush hour traffic, sporting or concert events, and evening dining and social outings.

At the time of this writing, both Lyft and Uber apps provide a feature that allows drivers to indicate a destination and thereby bias the ride assignment algorithm to take drivers in a desired direction. This feature was introduced by one of the major ride-hailing companies, then quickly adopted the other. Many drivers use this feature to head toward home at the end of their work period. One savvy driver would use it to earn some extra money by sharing his car with a rider going his direction en route to his “day job” each weekday.

When this “destination” feature first debuted, some savvy drivers determined that if they set a busy airport as a destination on early weekday mornings, they would be rewarded with riders taking longer, more lucrative rides from the suburbs to the airport for morning flights for business travel. Quickly, the ride-hailing companies responded by adjusting their matching algorithm and pay structure to eliminate this behavior.

Some drivers living near state or city borders where ride-hailing systems are restricted (i.e., New York City) were frustrated when dropping someone off in a location from which they could not pick up another passenger. Similarly, changing local ordinances for “Uber-free zones” around hotels and airports and restrictions on car type (e.g., only hybrid or electric cars) in some areas confused drivers (and passengers) at times and in some cases influenced driver decisions such as choosing to purchase a hybrid over a conventional vehicle.

## **Rider Behavior**

Most drivers had a story to tell about poor rider behavior, but these were harder to draw out during the interviews. The online discussion groups were a richer source for these stories. Trends were somewhat predictable with hurried business travelers making up the majority of morning and evening airport runs and a younger, more boisterous crowd comprising the late-night ridership, especially around bars and restaurants. Drivers in some cities reported that business travelers tended to use Uber more than Lyft and that younger riders were more likely on Lyft. This influenced some drivers’ choice of apps / ride-hailing companies by time of day.

## **Allegiance vs. Multi-Apping**

Among the drivers for the ride-hailing companies, allegiance varied significantly. Some were Uber only drivers and some drove exclusively for Lyft. A driver's preference for one company over the other is affected by many factors. There are the realities and the perceptions of the fairness of the pay structure (e.g., the percentage of a rider's fare that the driver keeps). Some drivers reported that the pay structures were identical between Lyft and Uber, while others reported differences. Some drivers did not believe that the app correctly reported the agreed upon percentage of the fare—feeling cheated by the system. Others disliked company policies or news reports of various activities within the company.

Although allegiance to a single ride-hailing company could be quite strong, most drivers drive for both Lyft and Uber, and in some areas, others ride-hailing companies as well. Many adopted the technique known as multi-apping in which the driver turns on the apps of multiple ride-hailing companies, accepts the first ride that pops up on any of the apps, and then quickly shuts off the other apps. After dropping off the rider, the driver would then turn on the other apps again and repeat the process. An extreme example of multi-apping was seen in Austin, Texas where many drivers worked with all four of the app-based, ride-hailing companies serving the area (Fasten, Lyft, Ride Austin, and Uber).

After multi-apping peaked in popularity in 2018, drivers reported that both Lyft and Uber responded with strengthened incentive / reward / loyalty systems intended to increase their drivers' allegiance. These incentive systems typically entail a bonus structure that is based on completing a certain number of rides within a specified time (e.g., 10 rides in a day or 50 rides in a week). Many have responded to these incentive systems by focusing their efforts on a single ride-hailing company. Those who do a lot of driving can sometimes receive the rewards offered by both companies. Drivers who do this generally find it easier to switch between apps after completing a certain number of rides rather than the more rapid switching of multi-apping. Clearly these incentive systems have influenced driver behavior, but some are not happy about it. Even among those who work to achieve these rewards, some drivers responded negatively to the stronger incentive systems—feeling manipulated by the companies.

The ride-hailing companies compete for drivers' time and continue to use the incentive systems to attract drivers into driving more for their company. There are additional bonuses and perks available as well, such as for referring new drivers and for receiving consistently high ratings by one's riders. The driver can work to achieve a status symbol (e.g., "Diamond Rating") which appears when the app introduces driver and rider.

In a sense the reward systems offered by these companies in response to the drivers' multi-apping strategy could be viewed by the drivers as a loss of their autonomy in how they perform their work. In other words, their strategies to increase their fares by multi-apping have been thwarted or complicated by these new incentive systems. In some cases, drivers feel manipulated by these inherently extrinsic motivators. The free choice of drivers has been undercut by the companies.

## Car as Office

Occasionally, the front passenger seat was unavailable for us as riders. Some drivers simply prefer the slight increase in distance afforded by having passengers sit in the back seat. In other cases, drivers use their front passenger seat much like a mobile office for personal belongings, snacks, water (for driver and passengers), notes, receipts, phone charging equipment, and food (pizza boxes, etc.). This is the exception, however, since the default ride options for both Lyft and Uber (*UberX*) are meant to accommodate up to four passengers, which, for most sedans requires the use of the front passenger's seat.

Occasionally, when traveling with a group, and use of the front passenger seat was required to accommodate the group, the driver needed to clear off the front passenger seat.

## Business Functions Missing from the Driver Apps

We found that some driver tasks such as rudimentary dispatching and navigation are well supported by the company-provided mobile apps while other aspects of work were either wholly unsupported or poorly supported from the broader context of the drivers. While drivers for these ride-hailing companies are effectively independently operating franchise owners, the franchising companies provide drivers little in the way of tools related to business or financial matters. Here are some examples:

- **Vehicle ownership & maintenance.** While both Lyft and Uber offer options to lease a car from them, neither provides good tools for determining the long-term costs and benefits of owning vs. leasing a vehicle. Most Uber and Lyft drivers interviewed also seemed unaware of or had difficulty quantifying the cost of vehicle operation, maintenance, and depreciation associated with the miles driven, a finding also reported by Wiles and Sweeney (2019).
- **Tracking expenses & deductions.** Drivers also often fail to account for eligible business deductions. A common missed deduction is the mileage accumulated getting to the pickup point and between fares. There are no in-app tools to track and account for such driver expenses.
- **Business finances.** Surprisingly, many drivers do not know the proportional revenue they receive from fares compared to what the company keeps. Changing incentive systems that provide bonuses for achieving a certain number of rides in a given period further cloud the financial aspects of the business. While the app makes it easy to check income from a ride or for a day the lack of expense tracking makes it difficult to calculate profit (income minus expenses).

It is difficult to run a business without a line of sight to these financial issues. Such shortcomings of the app influence drivers in multiple dimensions—socially, behaviorally, financially, and emotionally.

## Looming Threat

Many of our drivers indicated that they had only been driving for the service for a short time (measured in days, weeks, or months) at the time of the ride / interview. This was particularly true at some point when Lyft and Uber were conducting significant (and clearly successful) driver recruitment campaigns. Some drivers, especially those who signed on with a ride-hailing company early on, lamented the increasing number of drivers, sensing that driver supply was outweighing demand for rides at times. That said, the elephant in the room, was the looming threat of competition, not from other drivers, but from driverless vehicles, for which the rate of maturity is anybody's guess.

## Motivation

Drivers reported a wide range of motivational factors affecting their decision to get into driving for ride-hailing companies and for the amount of driving that they do on a daily or weekly basis. Some of the common motives for driving included:

- **Extra income.** Some mentioned saving for a specific short-term goal such as a vacation or school while others looked at it as a longer-term supplement to another, primary source of income. As mentioned above, autonomy and agency provided by the flexibility in work hours, location, and the opportunistic income are seen as great benefits of the job.
- **Primary income.** Fewer app-based system drivers, but more conventional taxi drivers reported driving as a full-time business and primary source of income. Most who were relying on app-based ride-hailing systems as their primary source of income, generally saw it as a temporary solution while they were looking for other employment.
- **Staying active.** Some drivers had retired from other lines of work and indicated a desire to stay active and productive in their retirement years.
- **Recruiting riders.** A few drivers reported having a private car service in addition to driving for one or more ride-hailing systems. Some attempted to recruit regular customers to their private car service business while serving in the capacity of their ride-hailing driver.
- **Fundraising.** One driver reported that 100% of his profits go to funding a charity founded by the driver and some partners.
- **Family business.** Traditional taxi businesses are sometimes family owned. In those cases, drivers are sometimes recruited from among family members. Similarly, Uber and Lyft drivers often cited family members or friends as recruiting them into driving for one or more of these ride-hailing companies.

Note that most drivers reported multiple factors that influenced their decision to both get started with and to continue with their paid driving. As with any job, the decision to take it on is multi-dimensional.

## Technology Limits

While generally the technology that powers the app-based ride-hailing systems is amazingly reliable, drivers and riders both suffer when pushing the limits of the technology. One example of this is the difficulty with driver-passenger meetup—particularly in areas with a weak GPS signal such as in large cities where buildings, tunnels, and underpasses can cause *shadows* in the GPS signal. When the GPS signal fails or becomes inaccurate, drivers and riders typically resort to telephone contact for the final vectoring to the meeting spot. In one instance, the driver’s app automatically triggered the passenger pick-up function based on the proximity of GPS reported location of driver and rider. Twenty minutes later when the driver and rider were finally united, the app already showed 20 minutes on the meter when the rider entered the car. Such automation (in this case intended to help the driver who forgets to tap on the passenger pickup button in the app) sometimes backfires.

## Hailing Customer Support

As with other aspects of the relatively young app-based ride-hailing systems, the customer support functions for both riders and drivers are evolving. At one point during the early stages of our research, there was a billing problem that neither the driver nor rider could resolve through the app’s functions. Multiple attempts to contact the customer support team by phone resulted in the driver-rider pair trying every branch of a complex phone tree while on speaker phone together in the car. In the end, the pair determined that the only way to speak to a human on the customer support staff was to indicate via a phone tree option, that there had been an accident. Even after speaking with a customer support representative who could clearly track the path of our ride on a computer screen, we were instructed to attempt to resolve the issue by writing an email note to the customer support team. It was a frustrating and time-intensive way to resolve a rather simple system error.

This inadequate access to live customer support is not unique to ride-hailing companies. Many technology-based companies—often those which have undergone rapid growth and quick success in the market—offer minimalist customer support systems, choosing to forego the heavy investment in such high-touch support, and instead pointing their customers and their own employees to on-line self-governing communities for answers. These “rough edges” in their overall profile of services, however, can diminish customer satisfaction in the long run and possibly diminish customer loyalty as other competitors and mobility options enter the market.

## Safety

Perceptions of safety rarely came up during our in-car conversations with the drivers. We occasionally probed the subject, but understandably, it is a difficult topic to discuss. The biggest concerns seem to revolve around the perceived threat of the driver to the rider and the rider to the driver. Auto accident injury—while probably much more likely to result in actual harm—seems to be less of a concern than the potential threat of violence between rider and driver. Ride-hailing companies are actively addressing safety, mainly with respect to rider safety. As examples, these companies are increasing their focus on driver background

checks (some are adding what they call "continuous driver background checks"); they are also spending more attention to licensing and photo verification. They have enabled location sharing in their apps, allowing riders to broad-cast or point-cast to others, their current location. Some of these companies are monitoring rides that appear to have unexplained delays, in some cases querying the rider to see if they need help. Lyft and Uber both recently added a feature that allows a call to 911 directly from their apps.

## DISCUSSION: DRIVER RATINGS

As mentioned above, we were not in a client-consultant relationship with a ride-hailing company for this project and we were not funded by a grant. So, this publication and the related conference presentation are the first public dissemination of these findings. We hope that this work contributes in some way to the ordered search for better ways to accomplish service (mobility) to others. We also hope that those who are more directly involved in the business of ride-hailing systems will be able to use our findings to increase the agency of their drivers.

We offer one other idea for innovation and improvement in ride-hailing, and it is related to multi-apping, yet the suggestion could extend well beyond that. Perhaps ride-hailing companies could explore the idea of being more open in their software architecture, providing callable APIs or micro-services to other companies and software providers, encouraging better and easier integration of their services and fare data (pricing, availability and location of cars, etc.); this would allow a "compositing" and contrasting of fares, projected arrival times, etc. among providers within a single app.

This "open ride-hailing market" might help drive down the cost of transportation, allow more choice in bidding for work by the driver, and increase both rider and driver trust in the price algorithms used by various companies. It could also improve the ease of use of ride hailing applications for drivers, minimizing application switching, possibly even improve ride safety by giving drivers a more integrated workplace. This open ride-hailing approach could, of course, be extended to include other options for mobility by providing a more integrated view of all mobility options (e-scooters, bikes, public transport, etc.). RideGuru (<https://ride.guru/>) and Google Transit are examples of attempts to integrate mobility options for riders, but there is a need for greater innovation and deeper integration on this front.

Another high-level finding we found interesting is that many of the recent innovations in transportation / mobility options are blurring the once-sharp line between public and personal transportation systems. Sharing of bikes, chartering private jets, and ride-sharing are examples of this. In the case of the app-based ride-hailing systems of Uber, Lyft, and others, personal vehicles—once purely personal—can now be seen as a component of public transportation.

Furthermore, we hope that our expeditionary, low cost, scrappy, ubiquitous approach to the practice of ethnography will encourage others in our field to adopt a similar mindset allowing us all to discover the good of work—both as observer / researcher and performer (e.g., cabbie, Lyft or Uber driver).

We have pointed out the value of ethnographic tools and how simple and fun it is to learn about a problem while "on the go." We claim crucially that ethnography—while it can

and should be used more formally—is also a “good habit of the mind” that keeps us thinking and always learning.

As these app-based ride-hailing systems mature in the market and evolve toward driverless systems, we will need a deeper understanding of how driver and rider interact—what functions and supporting roles each perform for the other. This deeper understanding will be necessary in order to design systems which fully support the needs of all humans in future mobility systems, including systems which may not include a driver. This methodological approach can be used in other settings undergoing disruption and automation.

## **Coming Up Short**

We are keenly aware of some of the shortcomings of our approach to this research and can already think of things we might do differently next time. Here is a sampling:

- Driver complaints about passenger behaviors that appeared commonly in online forums typically did not come up during in-car interviews. We infer one of the weaknesses of the interview method is that drivers seemed to complain less about passengers when communicating with another passenger in person. Fortunately, the triangulation afforded by the monitoring of on-line forums provided additional insight in this regard.
- Over the course of our study, Lyft and Uber apparently changed or added features in their apps. As a result of the app changes over the course of the two-year sampling period of this study, it was difficult to assess these moving targets. Some findings related to the app discovered early in the study period were irrelevant by time of later observations. For example, when we started these interviews, Lyft made it easier for riders to tip their drivers than Uber did. Subsequently, Uber followed suit by building a tipping function into their rider app, which was easily accessible by the rider.
- Clearly the lack of audio and video recording of interviews made it difficult to capture verbatim comments. While this was a sacrifice, we feel that it was offset by the deeper, more open insights that drivers were willing to share.

We hope that the admission of these shortcomings and the teaching points below will provide food for thought to others who consider using our expeditionary style ethnography.

## **Teaching Points**

The purpose of this section is to list a few points that we pass on to those readers who may want to use this case study as a teaching tool. Consider the following discussion topics and questions as you unpack the case:

- Ask students to consider the expeditionary manner with which we approached this research. Compare it to a more well-planned, well-funded, carefully executed approach.



- Consider the pros and cons of conducting a literature search before embarking on a research project versus diving right into research and reading what others have found later.
- How might results have been different if we had used audio and video recordings, transcripts, and more quantitative analyses (e.g., counting the number / percentage of drivers who brought up a topic or shared a particular viewpoint)?
- How might a team study in more detail, the effects of future automation including the removal of human workers (i.e., driverless systems) on current drivers and passengers?
- What innovative design concepts do the findings from this study elicit?
- We did not enlist as drivers with either Lyft or Uber. How might our findings have differed if we had direct experience in the driver's seat?

We hope these questions spark interesting discussion between students, faculty, and professional peers.

## Epilogue

Though we are reporting here after approximately 150 interviews, we continue our data collection with each ride. We are proud that our rider ratings remain high.

**Keith Karn** has conducted user research since 1980. So far, his most memorable days include flying in a supersonic jet, studying operations in underground coal mines, and observing enteral feeding in Italian neonatal ICUs. Keith is principal consultant of Human Factors in Context, offering contextual research, human factors, and physical/digital interaction design. keith.karn@gmail.com

**William Hutson** is an IBM software engineer working in their Watson Health Division. Prior to moving into the health care area, he solved various design challenges in networking applications. Before he and his wife had children, they owned a beautiful yellow checker cab for personal use. hutson@us.ibm.com

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## Designing for Dynamics of Agency in NYC Homeless Shelters

NATALIA RADYWYL, *The Public Policy Lab; The School for Visual Arts*

*Public sector innovation (PSI) is an emerging multidisciplinary field that is attracting practitioners from a wide range of sectors and industries, with a correspondingly broad set of skills and experience. PSI aims to significantly improve the services that a government has the responsibility to provide by taking a user-centered, partnership-based approach, from service content development through to methods of service provision (OECD 2012). Yet the work is complex and not without risk, if undertaken without appropriate foresight, thoughtfulness, and rigor. In particular, when it comes to pursuing PSI in the design of social service policy and its provision, some of the more substantial risks lie hidden in systemic power imbalances that can easily be exacerbated, despite practitioners' best intentions. This article uses a case study about homeless service provision in New York City (NYC) to offer a candid portrayal of undertaking research and design work in PSI. It highlights common challenges and risks, as well as best practices for mitigating them. The issue of power is examined through the lens of agency, as it's a productive framework for helping to identify and work with the power dynamics that circulate between everyone involved in PSI design projects: the project team, research and design participants, intended end users, and the government client. In the spirit of making a pragmatic contribution to a burgeoning field, this article ultimately advocates for a reflexive practice. Working reflexively means inhabiting a mindset of self-awareness, reflection, and never 'turning off' as a researcher. This reflexivity enables practitioners to navigate the complexities of PSI design work, and ultimately, to better support their government agency client and those that the agency is aiming to serve.*

### INTRODUCTION

"Some people have been here for years. I can never see myself raising my child in this shelter... I have to focus on the task here and get out" (Resident).

She's buoyant, dressed in scrubs, smiling as she begins to talk. She describes arriving at the shelter with her young daughter and boyfriend; his departure not long later; juggling work, education, and childcare; her panic attacks; trying to be a good mother; wandering the local grocery store until the 9 p.m. shelter curfew because anything is better than "being inside". But the nine-month merry-go-round of case management meetings, apartment viewings and discriminatory knockbacks is over. She and her daughter have a home to go to.

This interview is just one of fifty-two that the Public Policy Lab (PPL) collected as a part of *Navigating Home*, a project completed with a New York City (NYC) social services agency. The project focused on understanding how the government agency and nonprofit organizations that run the city's homeless shelters can better assist residents in transitioning to permanent housing. The scale of this challenge is significant. At the time of writing this article in August 2019, approximately 61,674 New Yorkers were being housed in homeless shelters, including 14,806 families, and 21,802 children (Coalition for the Homeless 2019).

## Project Context

*Navigating Home* aimed to understand why the task of assisting NYC shelter residents in finding permanent housing is executed with varying degrees of success across the general population homeless shelter network. The project's focus was two-fold: understanding what makes some shelters 'positive deviants' (Pascale, Sternin, Sternin 2010) that consistently meet their move out targets; and understanding how housing specialists – a shelter staff member who assists residents in navigating NYC's housing market, understanding subsidies, and applying for housing – might be best leveraged to impact move-out rates.

PPL was enlisted to design and test interventions – such as tools, materials, and processes – that would support both frontline staff and residents in the effort of gaining and maintaining permanent housing. As a non-profit public sector innovation (PSI) lab that partners with government agencies to address challenges faced by low-income and at-risk Americans, PPL combines systems thinking and human-centered research, design, and evaluation methods. PSI is a growing field that aims to innovate public sector service provision through partnership-focused and user-centered practices. The PPL approach to policy and service delivery redesign reflects emerging practices in PSI. As a design firm that positions itself as an operational and strategic partner to government, PPL's practices are both strategic and material, focusing on system interventions that seek multi-level impact. These include policy changes through to behavior change compelled by new or improved interactions between people, as supported by digital and physical tools. From this perspective, *Navigating Home* was focused towards producing a 'proof of concept': identifying and validating areas of intervention that could improve move-out rates. In order to test the validity of these interventions, PPL collaborated with government partners, shelter staff, and residents to design and test a set of service concepts and related prototypes. The five-month project (December 2018 – April 2019) comprised 250 hours of field research and co-design with 215 shelter staff and residents across twelve shelters in NYC. This Phase One proof-of-concept work laid the foundation for Phase Two, in which program models and tools are being further developed and tested, leading to small-scale pilots.

## A Cautionary Note

A project such as this requires thoughtfulness and caution. With so many interdependent variables at play, practitioners must be mindful of the systems they're designing within and for. Broadly, these risks relate to power and potential unintended consequences of perpetuating unjust dynamics that already limit shelter residents' ability to seek and maintain housing, as well as frontline staff's ability to serve them. It is worth noting that this concern extends well beyond *Navigating Home*, as every social service plays a hand in perpetuating dynamics of power and agency. PSI practitioners need to be highly sensitive to these dynamics, asking: where is power in excess? Where is agency lacking but assumed, meaning that expectations can never be met as people aren't being empowered to do what's required or in their best interest? In addition, when considering the circulation of power and agency from a systems perspective, these questions need to be asked not just about the people being served, but also of the government agency client and the project team themselves. As one of PPL's directors noted, "one of the things we have to do in our work, as mediators between large government systems and individual humans, is to manage power

dynamics. We have to mitigate our own power – our own increased power over members of the community, and then we need to turn around and carry those stories into rooms of people who have more power than we do – in and over public systems” (2019).

If these power dynamics are not explicitly addressed and mitigated as a part of design practice, very significant risks relating to the unintended consequences may emerge, given that the service users are often at-risk and in vulnerable, disempowering circumstances. As Paola Pierri argues, “The question of agency is one that cannot be given for granted or ignored, especially when design practitioners are involved in societal issues where dynamics of exclusion and *self*-exclusion are at play, which can prevent people to act in their own interest...” (2017, S2956–S2957). Therefore, when designing for the social sector, designers must be cognizant of the complex systems that can either impede or aid an individual’s expression of agency.

This article therefore surveys what PPL learned during *Navigating Home* in terms of working with agency as PSI research and design practitioners and defining a methodology which was sensitive to its dynamics. Rather than presenting a blow-by-blow of each project phase and its outcomes, this article focuses on four areas that were most critical for team reflection and practice development when undertaking the project. These include:

1. Research planning that aims to mitigate likely power imbalances between the project team and their participants;
3. Data analysis frameworks that help identify unique systemic complexities relating to agency, and a process of data synthesis that enables prioritization of areas for design intervention;
4. Co-design practices that both redistribute power between the team and participants and result in effective prototypes; and
5. A client engagement approach that positions them as partners so as to become advocates for the project.

The article comes to a close with final reflections about *Navigating Home* and the subsequent proposal that PSI design work requires a ‘reflexive practice’. This is a project approach that demands self-awareness in light of the literacy required to negotiate power and agency.

While aiming to describe best practices, this article also intends to share a candid portrayal of the challenges associated with doing work of this kind. It does so to explicitly address the dearth of realistic appraisals of service design work, particularly around issues of power. As Yoko Akama (2009) and others (Blomkamp 2018; Kimbell and Seidel 2008; Pierri 2017) have noted, service design-related case studies often lack critical reflection, in part due to non-disclosure agreements or a reluctance to air challenges that may dampen emerging interest in a new field. The outcome of authors offering only a starry-eyed view of their discipline is that newer practitioners and future clients do not understand how difficult and complex this work is, nor learn about risks and how they can be mitigated, as Pierri emphasizes: “serious analysis of agency and power are long overdue alongside more optimistic accounts of collaborative design projects, which are seen most of the time as ethical and good in their own right” (2017, S2952). This article has therefore been written for readers who may be: working in the social sector and service delivery; exploring issues of reflexivity and power in their work; interested in systems thinking and human-centered design; working with vulnerable populations; or looking to shift from commercial to social sector design work.

## REDISTRIBUTING POWER THROUGH PLANNING AND FIELDWORK

One difficult reality of undertaking human-centered design in the social sector is navigating the power asymmetries that influence relationship dynamics between a project team and their participants. Imbalances are usually perpetuated by privileges relating to increased social capital and mobility, as well as the team's positioning as consultants who are empowered to hold space during fieldwork and make decisions that may directly or indirectly affect participants' lives. Unconscious biases (on the part of both participants and team members) may also reinforce this asymmetry. These seemingly entrenched dynamics raise a question as to how a project team can manage its likely excessive agency during fieldwork, and mitigate its impact on both participants and the project outcome.

The management of power imbalances requires sensitivity, but also tactical pragmatism. While it's beyond most designers' ability to fully mitigate the various forms of systemic disempowerment that their participants are subject to, they can develop a protocol for redistributing power in the research environment. This starts with research planning that explicitly addresses power in terms of how it may be distributed unevenly and how this may impact data collection, project outcomes, and the well-being of everyone involved. It involves asking: in what ways might the team be wielding excessive agency? To what extent can a team cultivate a research environment in which participants feel at ease, safe, and free to engage with the project on their own terms? While similar concerns have long informed reflexive practices that have emerged in various social science disciplines (particularly anthropology), there is currently little guidance for designers working in PSI.

PPL addresses the challenge of power redistribution at two levels during planning. These are largely to do with its approach to data collection and management, as reflected in their sampling and consent practices. However, both of these presented with their own unique challenges when undertaken during *Navigating Home*.

### Adaptive Sampling

A project team can attempt to redistribute power by making project-level considerations about whom data is being collected about – in short, an approach to sampling that seeks fair representation. Project outcomes can only ever be as good as the quality of data informing them, therefore if the sample skews incorrectly it's likely the project will suffer a correspondingly imbalanced outcome. When considered in the context of public sector work, design informed by poor data can result in project outcomes that at best, fail to adequately support the people using the service, and at worst, harm them. Yet, the recruitment of shelter residents can be challenging.

Following previous project work with shelter residents, the PPL team anticipated that recruitment and certainly long-term project participation – as is often desirable in human-centred design (and an aspiration in PSI design work) – would be made difficult by the transience that permeates residents' lives. Residents can be hard to pin down: they drop in and out of the shelter system, rotate through shelter intakes and assessments, or are moved to new shelters with little notice. Many avoid their shelter except to sleep, instead keeping busy with work or study and a life beyond its walls. Institutionalizing shelter routines – such

as curfews – act as a daily anchor, yet there is little that would enable the design team to secure reliable participation. Frontline staff can be similarly difficult to recruit. Their schedules change around residents’ needs and unanticipated events at the shelter. There could be no complete assurance that the team could engage a consistent sample of frontline staff or residents and fulfil specific demographic, let alone psychographic, sampling requirements.

Unsurprisingly, once in the field these concerns were realized. Not only was scheduling a consistent sample challenging, but on occasion shelters were simply too busy to recruit effectively for the team, as one PPL team member described: “sometimes they would grab who was nearby... sometimes they forgot that we were coming... that meant that sometimes the residents didn’t have the agency or the context of participating” (2019). The team were dismayed to hear one very anxious couple relay that they had been told that they were meeting someone from a government agency, rather than the independent design consultants patiently awaiting them. In these instances, the consent process (explained in detail below) became an essential tool for rebalancing power and allowing the resident to determine whether they even wanted to participate.

To counter inconsistent recruitment the team doubled down on data triangulation. If an interview didn’t yield the anticipated data, the team could at least gather a specific, highly detailed set of field observations, tap into the subject matter expertise of government agency and frontline staff, and seek out additional secondary research. In addition, they sought to hasten data analysis and synthesis by undertaking it while still in the midst of fieldwork (in the Burger King across the street, in cabs, the subway, while hunched over lunch during hurried breaks). This acceleration enabled the team to rapidly develop early hypotheses that could be tested early on, rather than risk discovering data gaps once back in the office after fieldwork was complete.

## **Humanizing Data Collection**

While all research and design participants should feel that the terms of their contribution to a project are transparent and within their control, this is especially important when the participants are homeless shelter residents. Institutionalized living regularly undermines feelings of independence and self-actualization, meaning that residents may be more sensitive to perceptions that their agency is being further eroded. PPL employs a research ethics protocol for data collection and management that aims to elicit and honor how each individual participant wishes to share their data. This protocol is grounded by principles of causing no harm, being honest, and being fair.

At one level, this plays out in the emotional dexterity it takes to create a supportive conversation environment: being sensitive to participants’ emotional safety while also being judiciously helpful, directing residents to resources as needed, although never giving advice. Power imbalances are also addressed through specific data gathering and storage protocols that aim to give residents control over their privacy, such as through the way that data is captured and stored. For example, the consent form is the only document on which the participant’s name is recorded. All other materials or files are labelled with a unique participant code and scrubbed of sensitive data. At the conclusion of each interview participants are also offered the opportunity to change, delete or retract comments, as well as review and delete any photos taken of them.

Conduct-informed data collection is perhaps most explicitly expressed through PPL's informed consent process. While gaining participant consent is standard in academic research and recognized as best practice in most industry-based work, PSI project teams need to be even more sensitive to and transparent with their participants. For *Navigating Home*, the interview moderator talked through each aspect of the consent language in aid of participants with low English literacy or disabilities that impede reading or written completion of the form. This was also a crucial opportunity to build rapport and trust in a bureaucratic moment that could otherwise easily alienate a population already subject to repetitive, and at times frustrating, paperwork. Like most consent forms, the project and discussion aims were stated in simple language, including who the project was for, how data would be used, and any risks or benefits to the participant. Yet, in light of the circumstances participants were living in, researchers also needed to be careful not to stoke false hopes by expressing unclear aspirations about the project's impact, particularly in relation to the participant's own circumstances or case.

PPL also aspires to give their participants granular control over the type of data being collected about them. For example, the participant had the option to circle 'yes' or 'no' to each form of data, including notetaking, audio-recording, video-recording, pictures in which their face couldn't be seen, and pictures in which their face could be seen (see Figure 1). In addition, the consent form offered a list of resources relating to discrimination, the reporting of shelter issues, and mental health, which the participant could keep. While most residents responded to the carefully laid consent process with some version of "I've got nothing to hide", it wasn't uncommon for the team to have stories of depression, trauma or prejudice shared with them. Without supportive resources on hand the team simply would not have been able to exercise adequate duty of care while out in the field.

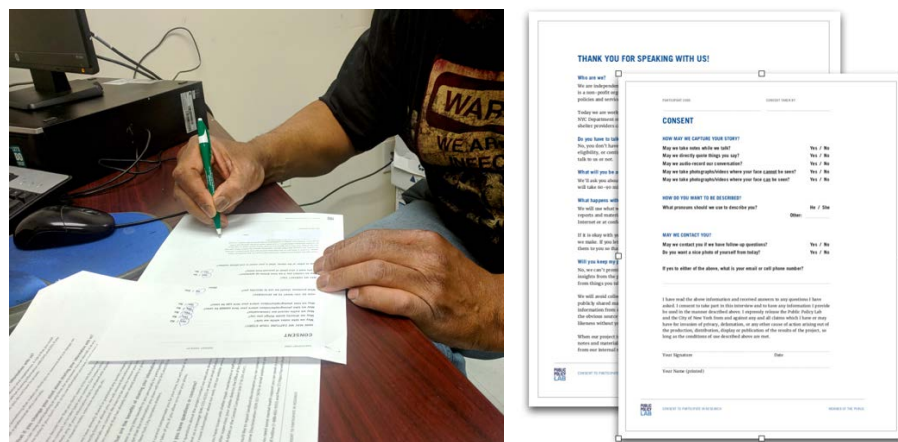


Figure 1. PPL's consent form. Photograph ©Public Policy Lab, used with permission.

The team also came to understand that consent wasn't simply a moment of interaction during the interview process. In one instance, as the research session progressed the moderator observed that the participant did not appear to be well and that there was a good chance that he would not have been able to fully comprehend the conditions of participation. While feeling conflicted by the risk of acting paternalistically, the moderator ultimately cut the interview short and withdrew the participant's data from the project.



## Fieldwork: Understanding End Users and Systems

The team undertook its first round of shelter fieldwork over the course of three blisteringly cold, mid-winter weeks. They travelled the furthest reaches of NYC's ailing subway system, visiting twelve shelters for about three hours each. They aimed to speak with two residents and two frontline staff (usually a housing specialist and a case manager) per shelter, as well as hold shorter conversations with operational leadership, such as the shelter or program director. In total they met with twenty-six frontline staff and eighteen residents. As fieldwork progressed, each shelter began to feel like its own laboratory – host to its own dynamics, practices, stories, and historical trajectory. Some were excellent partners, mines for learning and design ideas, and offering a strong spirit of cooperation and even transparency about the challenges they were facing. Others were less capable of partnership, often due to structural destabilization caused by a transition in leadership. In these circumstances the team could not breach their outsider status and had to contend with reading between the lines of the view they were being offered by the shelter.

## Resident Research

Resident interviews comprised questions about the participant's life story and how they came to be in the shelter, how they occupied their days, their perceptions about the type of support they were getting, followed by a short journey-mapping activity to chart the steps they had taken towards securing permanent housing, from shelter arrival through to the present day. This activity aimed to define key phases of a resident's time in a shelter, document any service interactions, the associated successes or difficulties, and their ideas for improvement.



Figure 2: Shelter resident participating in fieldwork. Photograph © Public Policy Lab, used with permission.

## Frontline Staff Research

Shelter staff interviews aimed to build a picture of how they approached their work (from personal motivation to responsibilities and activities), why some residents might be harder to support than others, as well as an overview of policies, training and systems. Staff participated in a journey mapping activity similar to that of the residents, however with a focus on capturing the tools, processes, and strategies used to support residents during their time in the shelter (see Figure 3). The team collected artifacts that staff were using to help residents (such as leaflets, websites), and especially those that they themselves had designed. Self-made tools can often be excellent seeds for design ideas as, in essence, these are prototypes that are already being tested.



Figure 3. A frontline staff member helping PPL map the rehousing journey.  
Photograph ©Public Policy Lab, used with permission.

## System Immersions

To round out their fieldwork the team also sought better understanding of the technological systems that their prototypes could either leverage or integrate with. They participated in agency-organized ‘system immersion’ sessions to understand: data flow between agency operations and shelters, within shelters according to their own protocols and processes (such as assessments and case management meetings), within and between databases, and relating to frontline staff’s use of case management software. The team was also invited to cross-functional meetings in which they could speak with a range of program and operational agency staff responsible for shaping the policy decisions that influence how shelters are run, and through group discussions elicit the challenges that most concerned them, as well as ideas for addressing them. Finally, the team met with a team responsible for the case management system. Here the aim was to see how PPL’s recommendations could support or even guide the current development roadmap.

## SYSTEMIC DATA ANALYSIS AND SYNTHESIS: IDENTIFYING INTERVENTION AREAS

“Sometimes when we talked to people about some of the challenges they’re facing I could identify the policy that took that safety-net away... increasing housing costs, gentrification, all of these systemic things... I would say that eighty percent of the folks that we spoke to were African-American. The communities are changing, people are getting pushed out of their homes, they’re dealing with housing discrimination, the cumulative impacts of [lack of] access to wealth and savings... The systemic barriers that people are facing... that is something I noticed when we were doing our fieldwork” (PPL Team Member).

With the core challenge of this project being to design service interventions that can realistically cultivate agency, data analysis would have to aid identification of moments in which the people who are due to be served by the project (in this instance, frontline staff and residents) could be truly empowered to act. There were two dimensions to identifying intervention areas. At one level, it involved conducting data analysis that differentiated between systemic barriers that were beyond the project’s scope and the factors that could actually be designed for – and that the team was best equipped to impact within the scope of their project. Methodologically, this involved a system-wide surveying of all of the challenges and needs that were captured during fieldwork, then determining the extent to which these were caused by large, structural factors that the team couldn’t directly impact, such as intergenerational poverty, economic conditions, or specific policies.

At another level, the team needed to determine whether all members of the target population could actually be designed for within the scope of the project. Here, data analysis was aided by use of a ‘mindset’ framework – a way to group participants’ attitudinal and behavioral patterns. Mindsets aim to encompass the dynamism of human experience, accounting for the fact that a mindset may change over the course of an hour, a day, or even a lifetime. Sometimes they’re triggered by a demographic variable like age, but more often they change with circumstances and events. Once a set of mindsets has been defined, additional validation during fieldwork helps to determine whether all mindsets should be designed for, or only a subset. Therefore, the outcome of data analysis and synthesis is a systemic mapping of how agency is expressed, denied, or supported; identification of specific areas for design intervention that can influence these dynamics; and a framework to guide the team in designing for true human needs and behaviors. These are described below.

### Defining Systemic Barriers

For *Navigating Home*, given the team had been tasked with identifying the system-wide factors that differentiate high- and low-performing shelters, the first step involved surfacing all of the factors affecting shelter performance, then distinguishing those that were beyond the scope of the project to affect. Data from participant observation alone was highly suggestive, in that it seemed to differentiate between low- and high-performing shelters in very visceral ways.

For example, the experience of arriving at some shelters was telling, with stringent security measures casting a foreboding welcome and residents listlessly clustering around building entrances. These were generally people who were unable to or couldn’t find work. They told the team that they’d usually be out in the neighborhood, but the bitter cold was

preventing them from venturing further afield. In these shelters, staff appeared to work autonomously and within well-worn hierarchies.

However, other shelters were bustling, warm, with residents and staff trading jokes and banter. In these shelters, walls heaved with community notices, as well as shelter and social service information. There were DIY efforts, such as ‘welcome kits’ (pots, pans, towels) on display that residents would receive upon departure to their new home (see Figure 4), and even staff-made posters that visualized the pathway to rehousing. Some had computer labs and well-publicized life- or career-skill workshops. There were also those that were actively partnering with local churches or community organizations to gather donations, such as books and clothing, or even to run programming. During one shelter visit, the team’s interview was interrupted by the clanging of an old-fashioned handbell. Staff and residents filled the nearby corridor with an excited, congratulatory buzz – someone had found a home, and it seemed that everyone was celebrating.



Figure 4. A ‘welcome kit’ on display at a shelter.  
Photograph ©Public Policy Lab, used with permission.

Yet regardless of shelter environment, there were factors that seemed to affect all shelters and impede residents’ ability to find housing. These included the lack of affordable housing in NYC’s notoriously tight rental market, clients with profound needs (usually mental and physical illness or substance abuse), as well as covert – and illegal – landlord discrimination, in which prospective tenants described being rejected without clear reasoning, but suspected factors such as their current housing status, race, and family make-up.

## Identifying Intervention Areas

Given all shelters were grappling with the systemic constraints described above, when identifying opportunities for intervention, further analysis found that difference in shelter performance often lay in the culture of service provision – of leadership, of staff collaboration, of the way each staff member chooses to conduct themselves. These differences manifest in concrete terms through shelter processes and outcomes, such as how proactive each shelter’s programming was, how effectively staff shared knowledge and best practices, the quality of tools and materials that staff were using to help residents, and how supported residents felt.

For example, the function of housing specialists – an explicit project focus, as described earlier – became a litmus for understanding how service experience might vary between low- and high-performing shelters. In higher-performing shelters, housing specialists were often positioned within a well-integrated, cross-functional team. Most frontline staff were equipped with enough housing knowledge to field residents’ basic questions, and housing specialists were sensitive to case management needs beyond housing. Program directors regularly gathered frontline staff to triage difficult cases and collaboratively develop a strategy to help residents progress. There were also practices in place for knowledge- and skills-sharing, so that everyone could be kept in the loop with informal – but important – information that the case management program doesn’t capture (e.g. a sick child). By contrast, staff at lower-performing shelters tended to work in isolation, reactively, were not supported as effectively, nor did they seem to be supporting each other. When considering these observations in response to the project goal of better leveraging housing specialists, it became clear that *Navigating Home* would need to develop design concepts that encouraged well-integrated, proactive staffing environments.

The team synthesized their data by collating the staff and resident needs relating to service experience that they had documented, then grouped them into sets of ‘shared needs’. These are needs that are jointly shared by staff and residents and indicative of service gaps, which, in short, are opportunities for design intervention. This practice of designing for shared needs aims to make a larger systemic impact by encouraging joint behavior change, therefore resulting in a more salient service intervention as it encourages positive behavioural interdependency between staff and residents. These shared needs were reframed as ‘service factors’, which, when well-managed, corresponded to higher shelter performance – as is described briefly below.

## Designing for Service Factors

### *Expertise*

“There’s no training that can teach you what I’ve learned” (Frontline Staff).

Housing specialists often transition from real estate; however some do not realize that they require more than a well-thumbed Rolodex for their job. They also need an excellent working knowledge of agency services, to coach residents by using empathetic, trauma-

informed ‘soft’ skills, and to exercise diplomacy in tough circumstances, such as landlord discrimination.

### *Relationships*

“She has no leads... What’s being put on paper are lies... I don’t know if it’s because they don’t have anything but they should be honest with clients. Let us know they’re at a standstill”  
(Resident).

“We want them to know that we’re all working on the same goal” (Frontline Staff).

After years of feeling like they’ve fallen through the cracks, some residents are mistrustful of frontline staff. Without sincere engagement, they may not recognize the support available to them, nor feel motivated to fulfill their own obligations. Good relationships could be built through mutual expectation-setting, by cultivating informal rapport, and showing mutual respect.

### *Resident Management*

“We don’t let anything slip, we address it head on... We meet the clients where they’re at”  
(Frontline Staff).

There are no ‘typical’ cases, but homeless services are largely predicated on a ‘one size fits all’ approach. If case manager assessments of residents could better evaluate each resident’s unique needs and intrinsic motivations, the service could be customized to meet residents where they’re at.

### *Timing*

“I’m just trying to do the best that I can... And I don’t want the shelter to think that I’m not doing anything to get out of here. It’s not a bad place. It’s just not mine” (Resident).

Motivation to move out drains rapidly. New residents often arrive with an air of determination, but have unrealistic expectations about how long it will take to find housing. Inertia can be countered by setting clear expectations about the search process, and identifying intrinsic motivators that re-ignite dwindling momentum.

### *Goal-Setting*

“[Residents] feel like no one is helping them and they lose hope after being in the system for a while” (Frontline Staff).

Ideally, living in a shelter is just one period within a resident’s life. This time could be reframed as one of investment, rather than loss, as it could be utilized as an opportunity to build skills that could support independent living, such as budgeting, literacy, or self-care. Perceptions of consistent personal growth could also help build self-esteem and counter flagging motivation.

### *Information Channels*

“Everyone gives you different information” (Resident).

While some information is in noisy abundance (plastering entire noticeboards, or strewn inconsistently around the web), there are significant gaps. Both staff and residents seek clear information about tools for navigating the journey to permanent housing.

### **Crafting Mindsets**

Following synthesis of staff and resident needs, the team turned to defining resident mindsets according to the behavioral patterns and attitudinal tendencies they had documented. When considering how mindsets pertain to shelter move-out rates, it’s plausible that the extent to which residents are able to express the agency necessary to independently search for housing will depend on their mindset – a combination of attitudinal and behavioral factors. For many residents, for example, agency is diminished the longer they live in the shelter, as shelter life is both highly institutionalized and institutionalizing. Residents have little privacy, must eat when and what they’re told to eat, and must obey curfews or risk losing their bed. A proportion of residents have also already become enculturated to institutionalization for a better part of their lives, be it from living as children with homeless parents, spending time in institutionalized care, or for some, spending time incarcerated. Yet residing in an institutional environment wasn’t always viewed negatively, as it offered stability, relationships, and often much-needed support. However, institutional dependency could also heighten anxiety about the prospect of living independently. As one resident commented, “It’s a big transition. You get used to shelter life and when you’re out on your own, it’s depressing.”

In the context of people experiencing homelessness, the mindset framework recognizes that agency isn’t just something that needs to be made available to a shelter resident. Agency is something that’s expressed. It’s a practice that may require support depending on each individual’s circumstances. Yet it also takes into account the systemic barriers that might impede an individual’s ability to find housing, despite their sense of motivation or best efforts. These barriers relate to systemic factors described above, such as profound health needs. Some residents are able to progress proactively and are successful finding housing. Others are eager to move out but find that systemic challenges hold them back. And still others aren’t able to progress, but don’t seem to present with evident systemic barriers. This framework therefore makes it possible to scope design interventions that avoid perpetuating a ‘one size fits all’ approach, and avoid significant unintended consequences, as described by Donetto et al: “...the discourses of service user empowerment and democratization of service provision risk being deployed simplistically, thereby obfuscating more subtle forms of oppression and social exclusion” (2015, 242).

Following these observations, the team developed a matrix of four very broad resident mindsets that reflect two continua: the extent to which someone is intrinsically motivated



and/or able to express agency, and the degree to which someone's case complexity – the challenging systemic variables – impedes their ability to progress (see Figure 5).



Figure 5: Resident mindsets used to explore the scope of potential design interventions. Graphic ©Public Policy Lab, used with permission.

While validating mindsets during fieldwork the team learned that *Navigating Home* would be most effective for two of the four mindsets. Frontline staff felt that the first mindset was typical of someone new to the shelter system, a circumstance in which motivation and ambition are plentiful, and needs to be swiftly leveraged while still abundant. They also proposed targeting the second mindset, as a vast proportion of residents were felt to fall into this group. Their needs, as opposed to those of the third and fourth mindsets, are not significantly profound, and therefore seemed good candidates for improved support. The final two mindsets reflect the experience of someone grappling with very profound needs and coming up against a range of systemic barriers. Designing for these mindsets would require more scope than was available to the team, given the sheer complexity of challenges, policy areas, and services supports that would need to be designed within. Overall then, while the project outcomes aimed to support all residents in some way, the design interventions were optimized to support residents falling into the first two mindsets.

## CO-DESIGNING FOR POLITICS AND PRAGMATISM

The value of co-design in PSI can be thought of as two-fold. On one hand, it's a pragmatic, design-led methodology for innovation that aims to generate new solutions by virtue of having engaged end users in the design process, as outcomes will more accurately address real needs and behaviors. On the other, there is an explicitly political aim. Given its roots in participatory design, co-design can aspire towards a similarly democratizing function. It can both empower participants during the process of co-design and result in artifacts that are empowering for end users (Blomkamp 2018). However, co-design is a practice that requires a sincere thoughtfulness and skilled facilitation. Designers must surrender the 'expert-led' mindset that is typical to design practice and instead enable participants to take up the reins as experts, so that their tacit knowledge can be surfaced and become a driver for design (Sanders 2008). In *Navigating Home*, co-design was especially challenging due to the trauma that pervades homelessness. Frontline staff confirmed that it would be likely that most residents would have experienced some level of trauma in their lives, and further, if to cast personal histories aside, living in a shelter in itself can be considered traumatizing. Frontline staff themselves had reflected on the toll of working in a traumatic environment. PPL's co-design practice therefore needed to support a trauma-



informed approach. This involved being particularly sensitive to their perceived power as design experts and by using tools that facilitated participant expertise.

## **Trauma-Informed Co-Design**

While PPL's team has had experience working with at-risk populations, and some members had previously worked with homeless participants, none of the team are trained social workers or therapists. Some team members felt this gap acutely while conducting research in the shelters, grappling with the emotional challenge of bearing witness to trauma while simultaneously navigating the discomfort of their own comparative privilege. In addition, some struggled with feelings of powerlessness as they watched evidence mount about the magnitude of the factors that underlie homelessness – poverty, intergenerational racism, inequity – the systemic factors that lay beyond the scope of the project. As one team member reflected, it was confronting to witness how significantly systemic barriers were impacting people's lives while also realizing the limits of one's own agency as a practitioner, and to proceed knowing that no single project could resolve those intractable challenges.

“Initially it was very challenging because you are trying to get particular types of information from people and they are sharing other pieces of information that they feel comfortable sharing, but you know you have no way to help. They're not even asking you to help, but even just as a caring human being – hearing that is tough. It's actually emotionally draining... I was physically tired.... I felt bad that my help was not impactful. How do you navigate these spaces?” (PPL Team Member).

In recognition of the realization that a responsible co-design practice would need to both support the well-being of participants as well as the team itself, PPL enlisted the support of a clinical psychologist specializing in trauma. He visited the office bi-monthly for the remainder of the project, something of an experiment for both the therapist and PPL. During debrief sessions he guided the team through the trauma they were witnessing, while also exploring their feelings of frustration and disempowerment in not being able to have a more immediate impact. The team was coached on creating a reassuring and safe environment through conversation cues, as well as interview closure practices, such as inviting residents to linger with the team after the interview, should they need time to settle before departing the privacy of the interview room. The sessions thus became an important space for pragmatic reflection outside the rush of project work, marking a new process of periodic reflexivity that enabled the team to develop a practice of exercising improved duty of care with residents, themselves, and each other. In the interest of deepening trauma-informed practices and honouring a space of reflection, the psychotherapist meetings have become a permanent and valued fixture at PPL.

There's a thing about boundaries. It's about the emotional capacity and maturity that it takes to be an individual representing an organization while looking at another individual who is living in some incredibly difficult circumstances. To be in that moment, to actually be compassionate, to actually care about the individual, but know that you can't actually change that individual's life... The work we do is hard. I think it's pretty foolish for any one of us to think that we could engage with some kind of difficulty in people's lives and complex systems without observing the trauma affecting us... If you are drawn to this work it is because you care about the world ... But you've also made a strategic choice to do that at a

systems level... and complicated feelings are going to come up with that (PPL Director 2019).

## Outputs: Service Concepts

For the co-design phase the team returned to a selection of their original shelter sample, aiming for a tighter, more focused engagement with a smaller cohort of participants. Where possible they invited participation from their first participant sample, given that a trusted relationship had already been established. In total, they conducted co-design sessions with twenty-nine frontline staff and twenty-three residents. Putting trauma-informed co-design practices into play, these residents and staff members guided the team through the process of identifying prototype use cases, turning rough single-page sketches into journey maps and worksheets, parsing language into more relatable terms, and helping a visual language emerge (see Figure 6).



Figure 6. A frontline staff member participating in a co-design activity with PPL.  
Photograph ©Public Policy Lab, used with permission.

The team also took advantage of an opportunity to hold co-design sessions within the agency's quarterly housing specialist trainings, which every one of NYC's housing specialists was due to attend. They ran an activity that encouraged staff to design their 'dream training' with respect to content and format, and a mapping exercise to identify residents' needs when moving into permanent housing (see Figure 7).



Figure 7. Housing specialists participating in a co-design session with PPL.  
Photograph ©Public Policy Lab, used with permission.

The final outcomes of co-design were four service concepts spanning a range of intervention areas. The service concepts were validated through prototype-testing in which new tools, materials, and processes were designed with residents and staff, and that aim to encourage behaviour change in interactions between staff and residents, as well as support intrinsic motivation and informed decision-making. The four service concepts, along with the design objective guiding their direction, are described at a high level below.

### *Triage*

“The Independent Living Plan is very client-focused but doesn’t include what case workers should do to help clients progress” (Frontline Staff).

Design objective: help frontline staff work proactively so that they can more easily meet clients where they’re at.

Research showed that residents currently endure lengthy and repetitive assessments that don’t always enable staff to make informed strategic decisions about the best path forward for their client. The team used the mindset framework to propose a tool that grouped residents into level of need, and to which a data-driven support pathway could be customized. This would enable residents to receive support tailored to their level of motivation, the complexity of their case (in light of the systemic challenges they were facing) and best option for rehousing, with optimized action steps for moving out.

### *The Journey*

“[The poster] would be so helpful because you really don’t know what is next. You know what people tell you... but you don’t have a clear picture of that” (Resident).

Design objective: provide motivating visual tools that make the journey intelligible to all stakeholders, build a spirit of collaboration, and enable everyone to undertake their responsibilities with greater ease.

Many residents don't have a full picture of what lies ahead in their journey towards permanent housing. The future looms unknown, and with it a heightening anxiety. Besides some DIY attempts, staff lacked a reference tool to help explain the rehousing pathway. In response, the team designed a service poster that could be pinned up in common areas and frontline staff offices. They also designed an accompanying worksheet that could facilitate goal-setting discussions during case management meetings, as well as track progress along specific steps. It both reinforced the formal compliance activities that residents needed to undertake, while brokering an opportunity to set additional personal goals, such as completing educational qualifications. The team also proposed that the progress steps be tracked in the case management system, and that a reporting dashboard be built. By generating progress data and having the ability to export reports, frontline staff and shelter leadership would be able to make proactive, evidence-based decisions addressing client, staff, and shelter-wide needs, ideally as a part of a cross-functional case review workflow. The Journey proved to be one of the most popular concepts among shelter and government agency staff, as well as residents (see Figure 8).

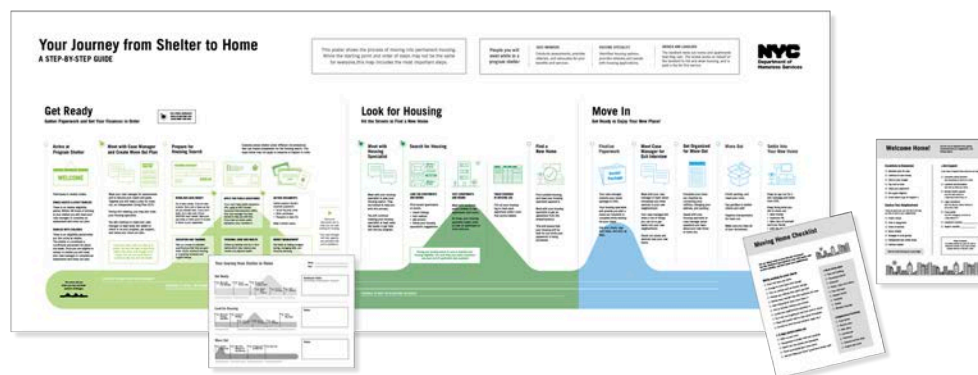


Figure 8. A sample of journey prototypes.  
Graphic ©Public Policy Lab, used with permission.

### *Move Out*

"It's not just placing people in a unit. It's about providing people advocacy and social service support once they're placed" (Frontline Staff).

Design objective: create low-touch ways for frontline shelter staff to help residents transition into and maintain permanent housing.

As discussed earlier, the transition to independent living can be very daunting for those who have lived in institutions long-term. While the team couldn't design an aftercare program within their project scope, they did develop a range of tools and processes that aimed to prepare residents for moving out, and make avenues of community support visible. These included a checklist that itemized all the steps a resident needed to undertake for a smooth move-out, from gathering personal documentation to purchasing household

essentials. A ‘settling-in guide’ listed activities and resources that could lay the foundation for independent living, such as identifying the local supermarket, public transportation, health services, community amenities, and places of worship. These tools would be featured within a new exit protocol that case managers and residents could participate in – a meeting that focused on customizing support, connecting the resident to resources, and providing reassurance. PPL also proposed that, after moving out, the former-resident could receive periodic multi-channel follow up communications to remind them of the avenues of support available to them, as well as their rights.

### *Training*

We are the tools for these clients (Frontline Staff).

Design objective: offer professional development for frontline staff that’s targeted, accessible, and impactful.

Both housing specialists and case managers were looking to grow their cross-functional expertise, as well as methods for more effectively motivating and empowering clients. In addition, housing specialists wanted to learn how to build their network of landlords and brokers and better communicate housing rights, while case managers wanted to better understand various public assistance rules. After surveying best practices and their fieldwork findings, the team recommended that trainings should be: practitioner-led so as to garner participant trust; reflect best practices in social service delivery by being grounded in trauma-informed, strength-based approaches; be delivered in multi-channel, interactive formats that can also be accessed asynchronously, with supportive materials that encouraged in-context use, such as meeting agendas, video clips, conversation guides, and tip sheets.

## **CLIENT ENGAGEMENT THAT EMPOWERS**

The success of a PSI design project rests on more than the quality of deliverables. To make a truly robust impact, government agency partners must be both meaningfully engaged and strategically positioned, as described by Mieke Van der Bijl-Brouwer, “Innovation is not just about designing products and services – it is also about designing an organization or system that is able to disseminate solutions. Innovation takes design to a systems level” (2017, 188). Government agency partners need to feel like they have skin in the game, genuinely understand the project and its potential, and are being supported to become advocates for the project.

### **Participatory Partnership**

When working with government agencies PPL aims to position itself as a facilitator and enabler. They take measures that encourage their clients and project stakeholders to take ownership of the project and become enthusiasts for its implementation. This approach is driven by a belief that the government agency is not the ultimate client needing to be served, as described by a PPL director: “We don’t call government agencies our clients. Government agencies are our partners, and we have a mutual client, which is the public. What we’re all working towards is increased opportunity for members of the public” (2019).

One learned best practice involves engaging an ‘agency leadership from the project outset. This group comprises executive and programmatic leaders who hold operational decision-making authority. As the future life of the project rests on project stakeholders’ shoulders, it’s important to cultivate ‘authentic trust’ so that the working relationship is sincere, reflective, and pragmatic (Solomon and Flores 2001). In the project plan, PPL outlines collaboration requirements to this end, including a request for a number of project partners to embed in the project team, attend fieldwork, and participate in internal work sessions. This invitation is similarly extended to the project funders. For *Navigating Home* PPL also worked with their primary government point-of contact to assemble a twenty- to thirty-person agency leadership group comprising staff who specialize in areas such as shelter operations, specific resident populations, staff training, and legal affairs. The group was kept abreast of project developments and attended ‘pin-up’ meetings following each project milestone, in which they contributed feedback and expertise to the project, as well as participated in co-design activities. These activities were essential for balancing user experience with operational feasibility, and to help craft short- and long-term goals for implementation. Without this collaborative engagement the project team risked developing design work that lacked the necessary buy-in and operational backbone for successful implementation. Following project implementation PPL will also conduct a series of progress evaluation check-ins at the three-, six-, and twelve-month marks, so as to support their partners with arising challenges and the task of assessing project impact.

## **Reporting with Agency Coordination Tools**

Throughout *Navigating Home*, reporting wasn’t a moment, but a process. Every meeting and pin-up contributed to the cumulative effort of equipping government partners and stakeholders with the stories, materials, and knowledge they needed to become advocates for the project and facilitate its implementation. This was a process of transferring agency through evidence-based storytelling that encouraged empathy for the people being served by the project, while also offering a pragmatic operational path forward, with the right level of strategic detail.

As the team regrouped after their penultimate pin-up, they noted that their stakeholder group and agency partners had focused on individual prototypes as catalysts for change. This was unsurprising, given that the team had been sharing discrete service interactions and their related prototypes in pin-ups, as compared to demonstrating distributed impact through the range of end-to-end service interactions they had been designing. Designing a service is ultimately about curating a flow of interactions, rather than a series of artifacts, as described by Akama: “designers are defined by what they enable, not what they ‘make’” (2009, 7). The team realized that they would need to better represent the deliverables at a systemic level, highlighting time, space, and human interaction, if to successfully convey the impact *Navigating Home* could make. The team therefore designed an ‘interaction model’ – a visual artifact that demonstrated resident and frontline staff interactions through one continuous, systemic experience, rather than a one-off interaction with a tool. While the tools they had designed could indeed be used independently, the team wanted to reflect fieldwork findings about client-centered, holistic, team-based models for work that suggested the tools would be most impactful when implemented together to support collaborative work practices. In

their final presentation they breathed life into the interaction model by presenting it through narrative-based storytelling.

The team supplemented the system view with a set of policy and operational recommendations to address the issues that couldn't be designed for within the scope of *Navigating Home*, but would nonetheless impact move-out rates immensely, if they could be addressed. These recommendations covered factors relating to staff training, suggestions for staffing and resourcing, conducting assessments, and both inter- and intra-agency workflow. These recommendations were shared with the belief that systemic impact can be greater when changes are made further up the power chain. Rather than frontline staff and residents largely shouldering the burden of responsibility for improved service outcomes, upstream policy changes could have significant flow-on effects: if programmatic agency staff are able to work more effectively within improved policy conditions, then they can better support frontline staff in their task of supporting residents.

## CONCLUSION

Navigating power and agency in PSI design projects requires a thoughtfulness towards each aspect of the project's making. PPL's approach started with the team itself, reflecting on its practices and how the project should be planned and managed with respect to power and agency. As the project began, the team was scrutinizing its expression of agency, aiming to be sensitive during interactions with participants and maintain strict data collection protocols that protect participant privacy. However, as the project evolved, they realized that despite best intentions, there were limits to their agency as there were systemic factors that they simply couldn't design for. Yet, when focusing on designing service interactions, the lens of agency became a pragmatic tool, as it helped identify the end users that would most benefit from their work, as well as the most appropriate areas for system intervention. The mindsets framework enabled them to see that some residents are ill-equipped to exercise autonomous behavior and that there will be limits to their self-actualization. When designing for frontline staff, the team had to recognize that they could not control for each shelter's working culture and operational complexity; however it was possible to design for the common factors that impede a staff member's ability to do their job well and encourage the factors that can support them. They focused on improved channels of support, training, models for internal collaboration, and building escalation pathways. And finally, the team sought to facilitate government agency partnership through close collaborative engagement strategies, such as embedding in fieldwork, co-designing in pin-ups, and strategic storytelling.

Ultimately, what evolved could be called a 'reflexive practice' that rests at the nexus of human-centered design and systems thinking. This practice requires a mindset and set of behaviors that ensure each user group is designed with and for according to their own unique circumstances. This also means that research is not an activity limited to fieldwork, but a constant process of information gathering that aids reflexivity. For *Navigating Home*, this meant considering how the homeless shelter system was impacting the lives of residents and frontline staff, as well as the ways in which their own actions and experiences were dynamically shaping it. This reflexivity extended into how the project team empowered its government partner to become a well-informed advocate for the work. It was also reflected in each team member's desire to practice self-awareness and sensitivity – towards themselves, their team, and the participants.



Phase One of *Navigating Home* is already showing early signs of success. There is an enduring trust and spirit of collaboration between the team and their government partner. The partner has also set workstreams in motion that mirror the spirit and ethos of human-centered social service design. Yet reflexive practice is an enduring work-in-progress. The PPL team aspires to enrich their work with more peer-led, participatory design processes, to further their trauma-informed practices, and to make greater systemic impact through engagements focusing on policy design and experimentation.

Indeed, as more researchers and designers are drawn to PSI, and more public sector staff take up research and design activities, it is imperative that all practitioners become adept at working reflexively, and that practices continue evolving in response to the complexities of system-embedded power dynamics.

**Natalia Radywyl** is a multi-disciplinary researcher and designer working at the intersection of social innovation, systems thinking, and design. She received her PhD in Media and Communications and Australian Studies from the University of Melbourne, Australia, and is currently the Research and Evaluation Director at The Public Policy Lab.

*nradywyl@publicpolicylab.org*

## NOTES

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Please note that the outlined project deliverables are currently in the process of being further developed and tested in a second phase of work, therefore may not reflect the final, implemented outcomes.

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## Bringing the Security Analyst into the Loop From Human-Computer Interaction to Human-Computer Collaboration

LIZ ROGERS, IBM Security

*This case study examines how one Artificial Intelligence (AI) security software team made the decision to abandon a core feature of the product – an interactive Knowledge Graph visualization deemed by prospective buyers as “cool,” “impressive,” and “complex” – in favor of one that its users – security analysts – found easier to use and interpret. Guided by the results of ethnographic and user research, the QRadar Advisor with Watson team created a new knowledge graph (KG) visualization more aligned with how security analysts actually investigate potential security threats than evocative of AI and “the way that the internet works.” This new feature will be released in Q1 2020 by IBM and has been adopted as a component in IBM’s open-source design system. In addition, it is currently being reviewed by IBM as a patent application submission. The commitment of IBM and the team to replace a foundational AI component with one that better aligns to the mental models and practices of its users represents a victory for users and user-centered design, alike. It took designers and software engineers working with security analysts and leaders to create a KG representation that is valued for more than its role as “eye candy.” This case study thus speaks to the power of ethnographic research to embolden product teams in their development of AI applications. Dominant expressions of AI that reinforce the image of AI as autonomous “black box” systems can be resisted, and alternatives that align with the mental models of users proposed. Product teams can create new experiences that recognize the co-dependency of AI software and users, and, in so doing, pave the way for designing more collaborative partnerships between AI software and humans.*

### INTRODUCTION

In the spring of 2018, some 18 months after its launch, a small team of IBM Security designers began working on QRadar Advisor with Watson – an artificial intelligence (AI)-driven security software application – in hopes that they could improve the product's user experience and increase adoption and usage. Not surprisingly, the design team had lots of questions for the broader product team. What did Advisor do? How did it work? More importantly, how did its intended users – enterprise security analysts – actually use the application, and did they find the information presented meaningful and useful? The answers to these questions, the Advisor design team argued, could not be gleaned from the typical client phone calls but instead warranted an ethnographic study of security workers – analysts and leaders – within the context of their work environment, Security Operation Centers or SOC's, for short.<sup>1</sup> See Figure 1.



Figure 1: Bulletproof Security Operations Center. Source: [http://media.marketwire.com/attachments/201702/72527\\_bulletproof-SOC-large-tiny.jpg](http://media.marketwire.com/attachments/201702/72527_bulletproof-SOC-large-tiny.jpg)

SOCs are typically staffed by experienced teams of security analysts and engineers, incident responders, and managers who oversee security operations. They tend to be rather imposing, dark spaces filled with security team members in their own workspaces, surrounded by at least two if not three screens. These teams are responsible for protecting company assets from security threats, which they do by monitoring, detecting, investigating, and responding to potential security breaches. Security operations teams use a range of technologies, software, and security processes to help them collect, monitor, and analyze data for evidence of possible network intrusions. One such software application is QRadar Advisor with Watson (Advisor). Advisor is designed to help analysts focus on the most critical threats to their network, investigate these threats more quickly, and identify possible breaches that weren't identified by other tools.

Building enterprise security software requires deep knowledge of information technology, the software development process, and the cybersecurity industry. While product teams need to understand the practices, experiences, and goals of their intended users, they also need to understand the technology behind the software. This can be particularly challenging for designers and design researchers who don't come from a computer science background. As a result, it is not unusual for IBM designers and design researchers to spend significant time when starting a project trying to understand what the software they work on is supposed to help users accomplish and how.

The introduction of designers and design researchers to development teams, however, has proved to be just as challenging for software developers and product managers who are not accustomed to being asked to think about their users' "as-is"

experience of their product, complete with pain points and opportunities for improvement.

QRadar Advisor with Watson today, by all accounts, is a complicated application: hard to configure properly, difficult to use, and not especially clear in the insights that it provides analysts. Designed and developed by software engineers more intent on making the backend technology work than the providing an intuitive and frictionless user experience, Advisor has encountered resistance from analysts who don't know how to use or interpret core features of the application. In addition, the application is not particularly well integrated into the broader software system in which it is embedded. Analysts can accomplish many of same tasks facilitated by Advisor, although not as quickly or easily.

Given the complexity of the product and uncertainty around how exactly analysts were or weren't using the application, the lead design researcher of the team lobbied for direct access to analysts and their colleagues within their work environment. It was only in observing and talking to security analysts and leaders doing their work within the context of the SOC that she felt she could properly understand how these workers did their job, why they preferred certain tools and resources over others, and their goals in using or purchasing the tools they did.

After first presenting a more technical description of the Advisor application, this paper provides some background on the field of cybersecurity and the hopes and fears associated with AI within it and the world it inhabits. The paper then proceeds to summarize the specific research goals and methods of the project, key findings, and research outcomes. It concludes with a summary of the project.

## **QRADAR ADVISOR WITH WATSON**

QRadar Advisor with Watson is a cloud-based application that is used by security analysts and incident responders to augment the capabilities of QRadar, an industry-leading security information and event management tool (SIEM). Companies employ SIEM solutions to monitor their environment for real-time threats and catch abnormal behavior and possible cyberattacks. QRadar, like other SIEMs, works by collecting and normalizing log and flow data coming from network infrastructure, security devices, and applications and comparing this data to pre-defined rulesets. If the conditions of a rule are met, QRadar generates an "offense" – a grouping of related "events" that have occurred on a network's devices – which serves to alert security operations that a possible breach in security has occurred. These alerts often are the first clue that there may have been unauthorized access and use of enterprise assets. Unfortunately, many of the alerts that are triggered by SIEMs are false alarms, and security analysts spend much time trying to ascertain if the alert is a true or false positive.

QRadar Advisor with Watson is designed to help security analysts quickly reach a decision on what to do next after receiving one of these QRadar alerts. Prominent in marketing materials is Advisor's status as an AI-enabled application. See Figure 2.

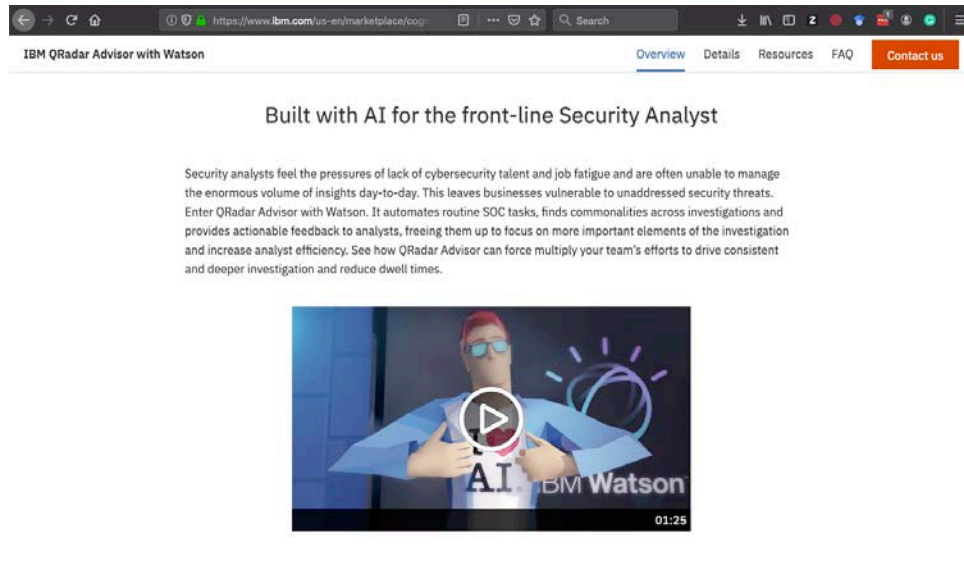


Figure 2: IBM's QRadar Advisor with Watson. Source: <https://www.ibm.com/us-en/marketplace/cognitive-security-analytics>

Advisor collects internal data from network logs and security devices like firewalls and antivirus devices and correlates this data with external threat intelligence that it has mined from the web. Advisor uses a Natural Language Processing (NLP) model to extract and annotate the external data, which are stored in a knowledge graph (KG). This is the “AI” or “Watson” part of the application. Knowledge graphs are powerful tools that can be used to show all of the entities (nodes) related to a security incident (e.g., internal hosts, servers, users, external hosts, web sites, malicious files, malware, threat actors, etc.) and the relationships (edges) between these entities. Figure 3 depicts an Advisor investigation of a security incident. The result is a comprehensive view of all of the entities involved in the original QRadar offense, along with additional entities in the network that have been identified by Advisor as being potentially affected based on the threat intelligence it mined using the NLP model.

Knowledge graphs, however, can get quite complicated, especially as security incidents can involve hundreds of nodes and edges. See Figure 4 for an example of an Advisor investigation of a complex security incident.

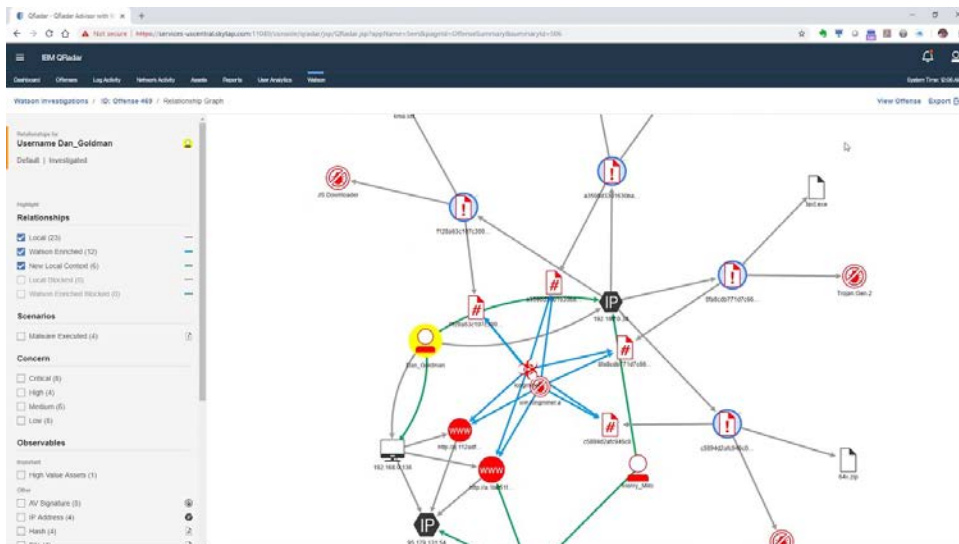


Figure 3: QRadar Advisor with Watson investigation. Source: <https://www.youtube.com/watch?v=a5xaY6THvKo>

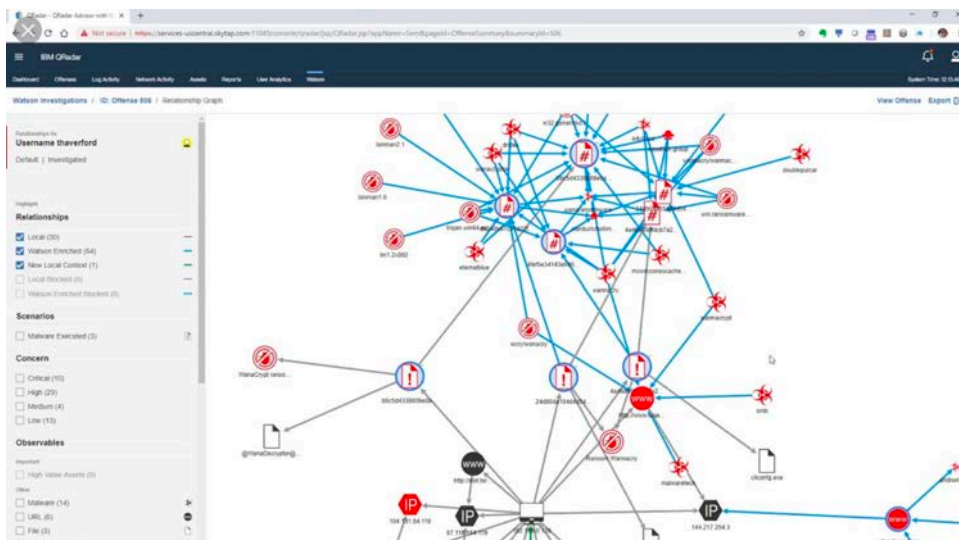


Figure 4: QRadar with Watson Advisor Investigation. Source: <https://www.youtube.com/watch?v=NaGpftxA2s>

## BACKGROUND

### Cybersecurity and AI Technology

In a recent 2019 Capgemini survey of 850 senior executives from 7 industries and ten countries, 69% responded that they would only be able to respond to cyberattacks with the help of Artificial Intelligence (AI). And why shouldn't they think so? AI for cybersecurity has been deemed "the future of cybersecurity" (Forbes 2019). According to at least one company making AI-based security software, AI is "liberating security" from "regular outmoded strategies to one of security as a "science" that brings with it "revolutionary change" (Cylance 2018). There is, of course, another side to the public debate over the impact of AI on the security industry. Customers have voiced disillusion with the over-promising of what AI- and Machine Learning- (ML) based solutions can do. Moreover, cybersecurity experts have warned of the "malicious use of artificial intelligence technologies," based on their prediction that companies will experience new bad actors who are using AI technologies themselves to exploit new enterprise vulnerabilities associated with AI systems (Future of Humanity Institute 2018).

While security experts might see AI as liberating security, AI experts outside of the security community appear to be far less optimistic about the possible effects of AI. For example, based on a 2018 survey of 979 AI experts, Pew Research Center reached the following conclusion: "Networked AI will amplify human effectiveness but also threaten human autonomy, agency and capabilities" (Pew Research 2018: 2). Although some AI experts did recognize possible benefits of AI – e.g., advances in science and humanitarian efforts – on the whole, the experts polled by Pew appear to have far more confidence that the negatives will outweigh the positives. For these skeptics, the adoption of AI technology will result in humans' loss of control over their lives, their jobs, the ability to think for themselves and, the capacity for independent action. (Pew Research 2018). AI technology, according to the study, could lead not only to a rethinking of what it means to be human but also to the "further erosion of traditional sociopolitical structures," "greater economic equality," a divide between digital 'haves' and 'have-nots', and the concentration of power and wealth in the hands of a few big monopolies.

### Pervasive Social Meanings of Computing

People have worried about the debilitating effects of new technologies since well before the emergence and popularization of Artificial Intelligence. Computing, in particular, has been a lightning rod for both proponents and critics of the power of technology to transform society and humanity's relationship to nature and the material. Since its introduction, the computer has quickly come to be seen as evidence that routine clerical work could be mechanized and automated – a good thing, confirmation that humans could be freed from repetitive labor and technology was a source of continual growth and prosperity (Prescott 2019).

This vision of computing, like those of previous technological innovations – e.g., steam railways, automobiles, radio and electricity (Pfaffenberger 1988; Moss and Schuutz 2018) – has much to do with Enlightenment ideas of progress and the transformative social potential of technology. This notion – that technological innovation represents human progress and

mastery over nature – forms the backbone of a “master narrative of modern culture” (Pfaffenberger 1992). In this master narrative, human history is a unilinear progression over time from simple tools to complex machines. Accordingly, computers are evidence of humanity’s increasing technological prowess, control over the natural world, and application of science. They are, in short, a root metaphor for social process in mechanized societies (Ortner 1973).

Not all people have embraced this master narrative, of course, and people seeking to reassert human autonomy and control in the face of mechanization resist and challenge these dominant meanings in numerous ways. For some, resistance comes in the form of introducing new technologies that subvert or invert commonly held meanings of existing technologies. Thus, the invention of the personal home computer can be seen as a strategy to reassert human autonomy and control through the subversion of dominant meanings and images associated with large-scale enterprise computers (Pfaffenberger 1988).

Others undermine this master narrative of technology and progress by subverting dominant themes and meanings attributed to new technologies like AI. Researchers like Moss and Schuur (2018) and boyd and Crawford (2014) have pointed out how the meanings and myths of AI technology and big data have contributed to an understanding of technology as objective, accurate, and truthful, and an understanding of humans as fallible, inefficient, and ripe for machine domination. Other researchers have focused on making people aware of just how dependent machine learning and AI models and algorithms are on humans (see, e.g., Klinger and Svensson 2018; Seaver 2018). As Seaver (2018) has argued, “In practice, there are no unsupervised algorithms. If you cannot see a human in the loop, you just need to look for a bigger loop.” Still others have drawn attention to inaccuracies in the master narrative: AI is not objective; there are biases in machine learning models and algorithms.

In exposing taken-for-granted truths about AI technology as myths, these researchers can be seen as authors of a counter-narrative. These counter-narratives do more than just call into question this master narrative, however. They question one of its fundamental precepts: namely, that technology is an external, autonomous force that develops according to its own internal logic. In so doing, these counter-narratives make way for understanding how technologies (and the material) might acquire agency and function as agents in society.

## **From Humans vs. Machines to Humans + Machines**

As AI technology becomes more and more sophisticated, it is hard to imagine not seeing AI artifacts as displaying agency and even autonomy. Even before the popularization of AI technology, however, agency – in particular, the notion of nonhuman or material agency – has been a rich source of discussion and inquiry for a variety of disciplines. Two approaches – one, techno-centric and the other, human-centric – both have been roundly criticized: the first, for its unproblematic assumption that technology “is largely exogenous, homogenous, predictable, and stable, performing as intended and designed across time and place”; and the second, for its minimization of the role of technology itself and its focus on the human side of the relationship (Orlikowski 2007).

In contrast to these approaches, “post-humanist” conceptualizations of the human-material relationship have been proposed that try to avoid the determinism of early concepts and challenge traditional approaches that restrict agency to humans. These alternative



concepts bring attention to the way in which humans and technology are inextricably entangled and mutually constitutive in practice. Moreover, they challenge notions of agency proposed by these other approaches. Agency is no longer defined in terms of an essential quality inherent in humans -- a "capacity to act" ala Giddens -- but as "the capacity to act" within "entangled networks of sociality/materials" (Orlikowski 2007). Agency is something that occurs rather than something that one has. Both humans and machines thus can be understood to demonstrate agency in the sense of performing actions that have consequences, but both kinds of agency are to be seen as intertwined, not separate (Rose and Jones 2005).

Neff and Nagy (2018) have gone so far as to argue the "symbiotic agency" is a more appropriate expression to capture the dynamic nature of human and technological agency in human-machine communications, in which users simultaneously influence and are being influenced by technological artifacts. Research that has embraced this way of conceptualizing the human-machine relationship recognize people's routines and technology as flexible, especially in relationship to one another: people will change their existing routines when faced with new technological tools and features, just as technological tools and features will be resisted and/or modified -- i.e., their material agency will be changed -- by people who aren't able to achieve their goals given the current tool or technology (Leonardi 2011). How people work, then, is not determined by the technologies they employ, regardless of how constraining they might be. Instead, people are capable (within existing conditions and materials) of "choosing to do otherwise" in their interaction with technological tools (Orlikowski 2000).

## RESEARCH GOALS AND METHODS

At IBM, design researchers need to be scrappy. Getting access to users of IBM products can be particularly challenging, and researchers often do not have the budget to pay for things like recruiting, transcription, and incentives for non-client users. Working for IBM Security adds additional complications. Many of IBM's security clients have mature security operations that have extended teams protecting their systems. Clients can be very reticent to share screens that include real network data or information that reveals how they have set up their security tools for fear of revealing their network vulnerabilities and compromising their security posture. More common than field visits to client Security Operations Centers or even video calls, then, are phone calls attended by members of a client's security operations (which may or may not include people who actually use the product) and interested IBM parties (e.g., technical salespeople, offering managers in charge of the business, engineers, and designers).

There is only so much, however, that can be gathered from such phone calls, and initial calls with Advisor "users", while informative, did not provide the team with a thorough understanding of the processes and tools used by security analysts, the goals they have in using these, and the constraints that they encounter in trying to accomplish these goals. Ethnography, the design team argued, would help them understand how analysts interacted with and made sense of the "data overload" and "noise" that marketing materials referenced.

Thus, in the late summer of 2018, IBM design researchers working on Advisor were permitted to shadow a handful of security analysts and leaders in their workplace. This research occurred in May and June 2018 and included visits to the SOCs of two IBM clients:

one, a large Managed Security Service Provider that uses IBM security solutions to provide security services to more than 500 customers; and the second, a large distributor of manufactured components with a security team of 10 globally-distributed people.

Researchers spent three days at the first of these two SOC's, and one day at the other. While visiting the two SOC's, researchers shadowed six different security analysts and met with one security leader and his direct reports. Visits, with permission, were taped using an audio recorder and transcribed afterward. Researchers did take pictures, although these cannot be shared as they contain client data. Research goals centered on the following three objectives:

- Understand how security analysts currently monitor threats and analyze, diagnose, and triage security incidents and what drive these behaviors;
- Understand how analysts are and are not using Advisor today to help them meet their objectives and why; and
- Identify how the team might improve Advisor so that security analysts can complete their investigations more efficiently.

Findings and recommendations from the ethnographic research were used to fuel an internal workshop that led to the identification of three user goals to guide the design and development of the next major Advisor release. The following user goal drove the reinterpretation of the graph: *An L1 security analyst can view what really happened in their network for a potential incident and complete triage five times more efficiently.*

After the workshop, additional user research was conducted to "validate" user needs associated with each of the identified goals and assess how different design concepts developed by the team did or did not help users achieve the stated goal. Most relevant to this case study are interviews with five security analysts recruited through respondent.io that focused on gathering user feedback on a set of alternative concepts, as well as discussions with eight additional security leaders and analysts from five different Advisor clients regarding the final design concept.

## KEY FINDINGS

### Competing for Analyst Mindshare

*Finding #1: Security analysts are reticent to incorporate new tools into familiar work routines, especially if they trust their existing tools and are effective in using them.*

Security analysts have many tools and resources – open source, public, and commercial – at their disposal to help them monitor network traffic for suspicious behavior and activity. Besides QRadar, the research team witnessed analysts using an array of network security devices (e.g., antivirus, firewalls, intrusion detection and intrusion prevention systems), threat intelligence feeds, anomaly detection and user behavior analytics, network access controls, and application-, network-, host- and infrastructure-related log collection. Information overload is a real problem for security analysts, especially because many of these tools and

data sources are not well integrated, forcing analysts to manually dig through these sources of data and correlate them.

With all the data they must collate and dig through, security analysts have developed their own practices and strategies, strategies which include the use of popular free tools and data. QRadar Advisor competes with these existing tools and resources in the minds of analysts, and it doesn't always win.

"I don't know if I really use it [Advisor] that much, because I have so many other tools that I'm looking at on a daily basis." — Security Analyst

## The Need for the Human Element

*Finding #2: Security analysts rely on their own personal experience and knowledge of their network to assess if an offense is evidence of a breach or a "false positive."*

The QRadar offenses investigated by analysts often are complicated, and the tools that they use are imperfect. Prior to starting an investigation, security analysts want to know which offenses to work on first. Offenses are not all equal in how critical they are to an organization, and not all offenses represent an actual security breach. Critical offenses are those that represent great harm to an organization, its reputation and digital assets. They often involve privileged users with system privileges or data access rights that others in the company don't have. Imagine if a phishing attack successfully compromised the Chief Financial Officer's laptop. That would be a critical security incident.

Sometimes offenses are "false positives," however, meaning a breach did not actually occur. There are a number of reasons why false positives happen, including: the rules are not tuned well enough to be able to recognize an action or event as benign, an application does not have access to all of the internal security data that is generated by a large network, and threat intelligence is not nuanced to distinguish URLs that are fine but are hosted on an IP address deemed malicious. As one security analyst told the team:

"I've had in the past where you guys have flagged legitimate traffic as, you know, malicious, and once I go down to the URL level, and I look at your threat intelligence, you guys have flagged a different site. It's hosted on the same IP, but I get 20 false positive offenses because there's some article about some celebrity hosted on some website in India where it's hosted on the same IP. And we operate in India, I've got staff, they're allowed to read the news, and when they come online, they share the story ... and I get a flood of offenses, and I go wild thinking like, 'Oh crap, we're getting like a mass infection event or something.' And it turns out it's not incorrect intel, but intel being incorrectly applied." — Security Analyst

Security analysts believe that there is no solution, powered by AI or not, that can completely know their network like they do. Not surprisingly, then, security analysts are suspicious of claims around automation and of AI omniscience: "Trust but verify" is a mantra the team has heard over and over in working with security analysts. Security analysts recognize that software is imperfect, and they see themselves as filling in the gaps of their security tools by providing the "human element."

"You have rules that caused the action to fire. In most any kind of programming, you cannot account for all variables. That's why you still have to have the human element to this, because it could be a benign thing between local and local. But it could easily be remote to local or local to remote with the same type of activity." — Security Analyst

## Prioritizing Immediate Versus Potential Threats

*Finding #3: Security analysts are more focused on protecting their organization's security posture from immediate threats than hunting down potential threats.*

In conducting ethnographic research, Advisor researchers discovered that security analysts focus more on identifying "what really happened" during a security incident than "what could have happened." The work of analysts consists of "putting together the trail to determine what happened or caused the issue." Things that "might have happened" or "could have happened but didn't" are simply of secondary importance for them.

"That's the whole point of the [SIEM] analyst. You have to analyze this data and come up with what's going on. You have to be an archaeologist of IT as you mine the information." — Security Analyst

"In my field, ultimately it's making sense of a lot of information and trying to glean what caused the incident generally after the fact. It's a lot of firefighting." — Security Analyst

Because analysts are so focused on the highest priority incidents, most of them do not feel that they have the time (or the mandate) to hunt for threats in their network proactively. This prioritization of immediate over potential threats has had a direct impact on security analysts' approach to Advisor and its knowledge graph. At the time of the research, analysts perceived Advisor as a tool for "threat hunters" that "have the time . . . to keep delving."

"This here [graph] gives the customer . . . the chance to look at these other IPs because they have time, they have resources, to look at this and further research it. We are dealing with events that are occurring." — Security Analyst

In the eyes of security analysts, their job is different than that of threat hunters": "An analyst's job is purely to look at the security posture, the security stance. Was that a breach? Was there an issue?"

## A Confusing Knowledge Graph

*Finding #4: Security analysts, especially less experienced analysts, do not know how to interpret the graph and thus do not understand the value it brings to their work.*

Spending time in the SOCs, the research team concluded that limited adoption and usage of Advisor was the result of not one but several factors. Unfortunately, not all of these variables could be addressed by the Advisor team. For example, network topologies

are often out-of-date, and, as a result, QRadar does not have an accurate or comprehensive view of the entire network. Solutions to this challenge were deemed out of scope for the project. The research team, however, did believe that there was one issue that could be addressed to great effect. Security analysts, the lead researcher argued, did not see value in the graph because the graph was confusing and didn't present information in a way that answered the questions analysts pose in determining the nature and extent of a possible breach.

On the one hand, security analysts' decision not to launch an Advisor investigation can be seen to be the result of their interpretation of how Advisor works and the information it provides.

"My understanding is that it's an assistant to pull QRadar info in so you don't have to go through all of this QRadar information . . . so with QRadar being pulled in, if you get this message here [in the Insight paragraph of Advisor] saying we found nothing, then you're not clicking on Investigate, it's all working background." – Security Analyst

On the other hand, the research also suggests that analysts are hesitant to use Advisor because of the complexity of the knowledge graph and their difficulty in knowing how to use and interpret the contained information.

Analysts, the research team discovered, want a solution that brings together all of the disparate information they usually have look up manually and presents it in such a way that they can quickly answer the following questions:

- Was a connection made from inside the network (by a computer, a device, an application, etc.) to an IP or URL that is associated with threat actors and attacks, or was it blocked?
- If a connection was made, is it a local-local connection or a local-external connection?
- If a local-external connection was made, what local assets are involved, and are they critical assets (e.g., the computer of the company's Chief Financial Officer)?
- If a local-external connection was made, was malware actually executed by a user?
- What type of attack (e.g., malware; phishing, denial of service) is being used against the network?
- Is this an evolving attack or something that has been contained?

This set of questions determines the workflow of analysts, as seen by one analyst's narration of the information that he was looking for while he was using QRadar to investigate a security incident:

"Was a connection between the remote host (and malicious observable) and local host made, or was it blocked? If it was blocked, is the system still trying to connect to it (e.g., it's a botnet CnC)? Is the local asset infected? What is the local asset that is in connection with the malicious observable? Who is the user? Was a payload locally executed? If executed, which assets have been compromised, in order of

priority? What has happened over the past seven days? Are new events being added to an offense?" – Security Analyst

In asking these questions, security analysts are attempting to quickly understand the following:

- If a breach has occurred or not
- The source of the breach
- The assets that have been affected and how critical they are
- The kind of attack they are dealing with
- How widespread the attack is

Together these variables allow an analyst to “put together the trail to determine what happened or caused the issue.” Very few security analysts the team met could answer the questions listed above with Advisor’s current knowledge graph. As a result, they could not quickly come to an understanding of the security incident.

Here, some explanation of how the product team intended security analysts to use the knowledge graph is warranted. For illustration purposes only, Figure 5 depicts an Advisor investigation of a simple security incident.

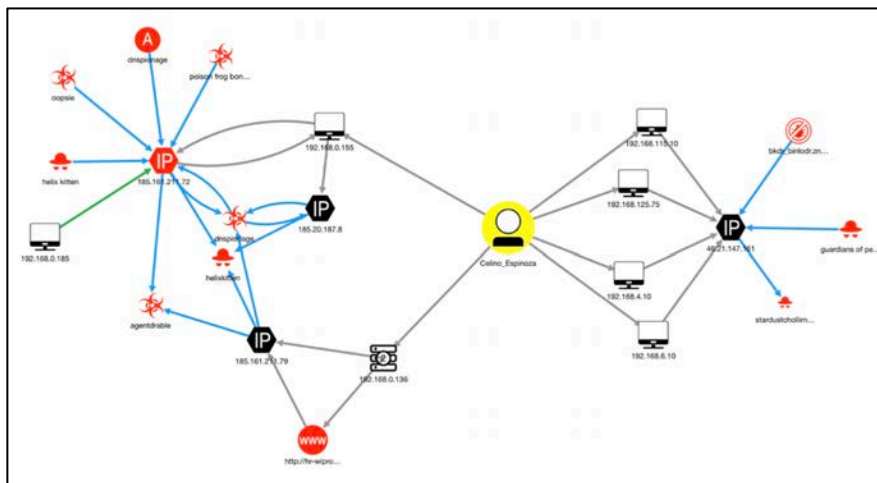


Figure 5: Initial Graph Generated by an Advisor Investigation. Source: SANS Organization 2019

Figure 5 depicts a security incident that can be summarized as follows: six different local assets (the black computer icons) associated with user Celino Espinoza (the yellow circle in the middle) have reached out to three different IP addresses (the black hexagons). In one case, it appears that the user went to a suspicious URL that is hosted on one of these IP addresses. All of the IP addresses in the graph show evidence of connection (and possible compromise) to a whole set of suspicious entities (all of the red icons) like malware, a threat campaign, threat actors, and a virus. Clicking on any of these icons will pull up additional information about that

node that can be used by an analyst to understand how critical the threat is. Clicking on any of the lines connecting them (edges) will bring up information about the nature of the relationship between two entities. Hovering over the IP addresses will bring up a geolocation map of where the IP address is registered and physically located.

While the graph provides a lot of useful information, analysts were not confident that it would help them quickly determine if an alert was a true or false positive and what their next steps should be. Analysts specifically mentioned the following as limitations of the current knowledge graph:

- The graph does not clearly indicate the entity that is the source of the offense or attack: i.e., where the attack entered the network.
- The graph does not clearly distinguish between which entities are inside of the network and which ones are outside of the network.
- It is not apparent what was blocked and what wasn't, what was downloaded and executed versus simply downloaded, making it difficult for the analyst to recognize and prioritize immediate threats over potential threats.
- The graph does not clearly indicate which potentially compromised machines are the most valuable, vulnerable, or critical.

Because of these limitations, analysts were often unclear of Advisor's value proposition, regardless of the marketing materials. Was the graph there to help them find the "root cause for an action to fire" and thus save them valuable investigation time? Or was it possible that Advisor was doing the entire investigation of the source offense for them? Was Advisor helping them identify additional indicators of compromise outside of an offense that they would have missed without seeing them on the graph?

## **Competing Meanings of AI and Advisor**

*Finding #5: Security leaders and analysts attribute different meanings and goals to Advisor's knowledge graph, resulting in different perceptions of the value of the application.*

When presented with a demo of the knowledge graph – say, at conferences or in sales-related talks – security leaders invariably respond positively to it, describing it as "cool," "complex," and "impressive." They can imagine themselves projecting it up on the wall of their SOC or using it in reports for management. Indeed, one of IBM's security executives admitted to the team that potential customers often found the graph the most exciting aspect of the application. Another internal consultant familiar with presenting the application to potential clients called the KG visualization "eye candy" for security leaders. The research team's conversations with security leaders also revealed their admiration for the diagram:

"It's complex, and it can impress people. You can put it up on a screen and show senior management, and they'll go 'wow!'. . . and it looks like the Internet. It looks complex and impressive." – Security Leader

This insight – that senior management favored the KG visualization much more than analysts did, based on the status and prestige it presumably conferred – was a revelation to the team. Security analysts with little to no experience of the Advisor, however, characterized the existing knowledge graph as "this big spider web" that "displayed too much data in a format that wasn't clear." For them, the knowledge graph is an intimidating artifact that is difficult to interpret and hard to verify.

## RESEARCH RECOMMENDATIONS

Despite the different meanings attributed to the knowledge graph, the Advisor team continued to believe in the value of a graphical representation of a security incident, however elusive. Creating such a representation is akin to finding the holy grail for the security industry.

"If you could get a graphical representation that shows you what you're looking for and at least points you in the right direction, it's worth a million bucks — compared to going through ten thousand rows, trying to find it yourself later, adding filters on filters on filters, trying to figure out what caused it or what happened. Trying to make sense of the data ... dividing it as granularly as you can without losing it in the noise." — Security Analyst

Research recommendations based on the ethnographic research did cover the knowledge graph, as well as other opportunities for improving the solution not discussed in this case study. Suggestions for how to improve the knowledge graph included the following:

- Explore new ways in which to organize the information mined by Advisor. Are there different metaphors that can guide the visualization of the graph? How can we align the diagram better to the mental models of analysts?
- Clearly distinguish between "what happened," "what didn't," and "what could have happened" in the knowledge graph — i.e., distinguish between the actual path of attack and any "what if" scenarios.
- Help analysts get started investigating by providing them with a quick, cursory overview of what they are dealing with.
- Allow users to keep digging from within the graph easily.
- Allow users to investigate offenses related by malicious observables, as well as known attack tactics and techniques.
- Identify which potentially compromised machines are the most valuable, vulnerable, or critical.
- Leverage users' strategies to distinguish between legitimate and illegitimate traffic and identify the incident type. Show them which connections were made and which ones were blocked. If connections were blocked, is the local host still trying to call out to the remote IP?



## RESEARCH OUTCOMES

These recommendations, along with an "as-is" investigation workflow, were the cornerstone of a 3-day workshop, in which the team identified three main experience objectives for the next major release of Advisor. One of these was: *"An (L1) security analyst can view what really happened in their network for a potential incident and complete triage more efficiently."* This goal became the north star for the Advisor team working on a new visualization of the graph.

### Putting Together the Pieces of the Puzzle

At the forefront of the minds of the two designers tasked with creating a new knowledge graph visualization was the desire to create something that would help analysts "connect the dots" so that they could tell the story of what had happened. Both designers recognized that the previous visualization, while technically correct, was not very consumable nor did it meet the goals the team had for themselves for designing for AI:

"We're the kids with a messy room when we create products. Something that may seem chaotic or out-of-place to our users doesn't seem so crazy because we created it. We live in this room, in our products. But we need to create something consumable, constructive, and structured when it comes to data visualization and bringing forward explainability and transparency from artificial intelligence." –  
Advisor Designer

Designers use metaphors to explain the new and unfamiliar in terms that people – users – understand. If the current visualization of the Advisor knowledge graph brings to mind the complexity of the Internet and the "black box" nature of AI, what then is an appropriate metaphor for a new visualization, wondered the designers.

After much experimentation, Advisor designers landed on a metaphor closer to how security professionals themselves explain their process and what it is that they do — a puzzle. Puzzles are composed of lots of pieces, some of which fit together, others that don't, and still others that might be missing. Their job, the designers explained, was to present analysts with all of the pieces of the puzzle that were available (e.g., the rule that triggered the offense, user and asset information, threat intelligence, malicious observables) and let analysts "fill in the empty gaps."

Using this metaphor, Advisor designers produced several different concepts, one of which featured the use of four "swim lanes." See Figure 6. This visualization of knowledge graph data addresses the primary reason why so many security analysts using knowledge graphs find them so very difficult to interpret, namely the absence of a structured flow through the nodes and edges. With traditional visual representations of a security incident knowledge graph, there really is no easy way to follow the path from the source of the incident to the possible threat, due to the many interrelated branches.

In contrast to existing visualization, this new way of visualizing a knowledge graph reduces complexity by clustering related entities together. Related entities that can be clustered together are determined not only by the type of the entities, but also by the threats impacting them. The new graph representation also provides an easy-to-follow path starting

from the source of the security incident – typically a user or an internal asset or an external entity – and leading to the threat that allows the security analyst to quickly identify how the security breach proceeded through their network. And, finally, it reduces the clutter of the old diagram by allowing security analysts to selectively expand clusters they would like to see more details on.

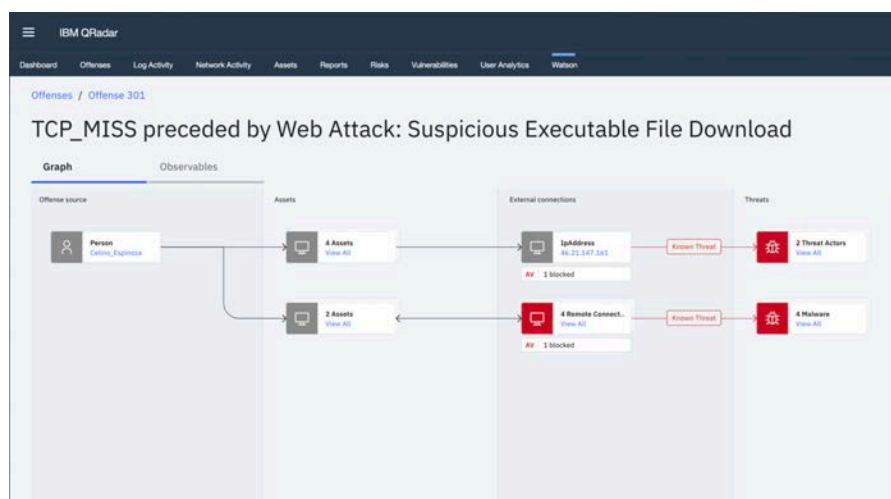


Figure 6: Proposed Knowledge Graph Visualization. Source: IBM QRadar Advisor with Watson product team.

In effect, this new diagram quickly provides analysts with the answers to their questions by mimicking their workflow and aligning with their mental model of how attacks work. The diagram makes clear what the source of the offense and attack is and where the analyst should start the investigation. Also made explicit are the internal assets that are involved in the security incident. The diagram also identifies any external connections that were made to any suspicious or malicious URLs or IP addresses, and clearly calls out if network security devices did or didn't block the threat. Payload information is available from within the diagram, as is additional information about all of the entities and their relationships to each other. Lastly, the type of threat and its success or failure in compromising the network is clearly communicated.

With this new visualization, the Advisor team provides analysts with all the puzzle pieces they need to make a quick assessment if an offense represents a false positive or a real threat.

## RESEARCH IMPACT

After the ethnographic research and workshop, the Advisor team worked closely together with security leaders and analysts to develop a KG visualization that met the agreed upon goal of *“an analyst can view what really happened in their network for a potential incident and complete triage more efficiently.”* Interestingly, both security analysts and leaders appreciate the new diagram and for similar reasons.

“The new concept would absolutely be easier to determine if it is a false positive or if something needs to be looked into more or escalated. It’s much easier for us to see the flow of what was going on.” — Security Analyst

“It has the [data] structure, the involved information, and clear definitions of the types of connections and assets.” — Security Analyst

“Honestly, I really appreciate the way the information is organized on this graph. It’s A LOT cleaner. We have had many offenses when the investigation will have several hundred IPs on it, and it’s just almost impossible to easily glean important information out of those. There’s just so much clutter on them.” — Security Leader

It is true that some security leaders asked if it was possible for the Advisor team to support both diagrams. When told “no,” however, security leaders opted for the new diagram, undoubtedly in part because of their own background as analysts.

A new version QRadar Advisor with Watson complete with the new KG visualization will be released in Q1 2020 by IBM. Time will tell if the new graph diagram will increase usage and sales, but the team (including upper management) remains confident that they made the right choice. This certainty is, in large part, due to the research that drove the decision to work on a new knowledge graph visualization and research that validated the preference for the new diagram.

The design team’s work on Advisor has also had an impact on how teams are approaching designing for AI at IBM. The design team regularly consults with teams across the business on how it arrived at the user-centered goals that drove the development of a new AI-powered experience. In addition, the graph has been adopted as a component in IBM’s open-source design system and is currently being reviewed by IBM as a patent application submission.

## CONCLUSION

People, in general, are conflicted about AI. According to one dominant narrative, humans will likely experience a future made more productive and efficient by Artificial Intelligence. Counter-narratives, however, predict a different kind of future – one in which humans become less autonomous and in control of their lives and are incapable of making decisions and taking action independent of AI tools and technologies. The customers and users of QRadar Advisor with Watson are no different. They believe in the power of AI to advise them of what they don’t know and what they should do, but they also question the ability of – and their desire for – a tool, any tool, to replace them, the human element.

Like our users, AI enterprise solution product teams are conflicted. They believe in the power of the AI products they are designing to benefit the lives of users, yet they also recognize that they are developing products whose goal is to reduce the need for human effort (or what are wistfully thought of as “lower order” tasks and skills).

Humans are – and always will be -- a necessary part of the equation. Humans are not just consumers but active producers of the insights that AI models produce. Humans are the agents that create the interfaces and visualizations that people use to interact with AI models and AI-generated insights.

In exploring how the Advisor team came to the decision to replace one KG visualization with another, this case study demonstrates just how entangled humans and technology can be. It also suggests that AI agency and autonomy are less of a threat to humans and human agency than certain parties would suggest. Could it be that Artificial Intelligence is really more of a neutral force whose exact influence shapes and is shaped by humans engaged with it.

That change will occur with the introduction, adoption, and adaptation of new technologies is certain. The exact nature of this change is not, however. In challenging the way in which AI-powered insights are represented to analysts and proposing a solution that better aligns with their own mental models, the Advisor team undermined the notion that humans have no role in the future or expression of AI. It took people – designers, engineers, offering managers, security analysts, and security leaders committed to developing a product that users could use and get value from – to find a way to present the information in way that was consumable and, in the process, reveal the co-constitutive nature and required human element of AI. In so doing, they call attention to the ways in individuals can challenge the trope of AI as the harbinger of a future in which individuals are made more productive yet less autonomous.

Recognizing humans and nonhumans as partners in a symbiotic relationship challenges the concept of “human-computer interaction.” Designing from a shared agency perspective means that product teams must consider the interdependence of humans and nonhuman actors and design for two entities. As Farooq and Grudin (2016: 32) argue, “The essence of a good partnership is understanding why the other person acts as they do. Understanding the intricate dance of a person with a software agent requires longitudinal or ethnographic approaches to produce realistic scenarios and personas.”

**Liz Rogers** is a design research practice lead with IBM Security. After receiving a PhD in cultural anthropology from the University of Wisconsin – Madison, she entered the world of product innovation and never looked back. She has over 18 years of experience working in the design industry, helping teams design compelling products and experiences, based on a deep understanding of user needs, motivations, and behaviors.

## NOTES

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1. In smaller security organizations, it is not uncommon for one individual to cover multiple roles, including security leader, security analyst, incident responder, and threat intelligence analyst. Larger, more mature security teams typically distinguish between these roles with differing degrees of granularity. Each of these roles can be identified in multiple ways. A simple search using a website like Indeed.com brings up multiple ways to identify the people who take on the responsibilities and tasks associated with “security leaders” – e.g., creating, implementing, and overseeing the policies,

procedures, and programs designed to limit risk, comply with regulations, and protect the company's assets from both internal and external threats – like Chief Security Officer, VP of Security and Risk Manager, and IT Risk Management Director. Similarly, people whose top jobs to be done include protecting company assets against tools of attack and attacker, detecting the occurrence of cybersecurity events, and investigating the activities and presence of attackers include people working as SOC Analysts, Information Security Analysts, and Security Engineers. For the sake of clarity and simplicity, in this paper, individuals who perform similar tasks and have the same goals, pain points, and needs in performing these tasks are all referred to by a common title, in this case “security analyst” or “security leader.”

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## Boundary Crossings

### Collaborative Robots and Human Workers

BRUCE PIETRYKOWSKI, *University of Michigan-Dearborn*

MICHAEL FOLSTER, *Behco-MRM*

*Agency and automation is explored through three case studies of the use of Cobots – collaborative robots – in three different auto production firms. The business challenges faced by these firms include labor shortages, quality control and reduction of waste. The Cobot solution resulted in different effects on agency through (1) agency task displacement, (2) agency enhancement and (3) agency expansion. In addition, the individual characteristics of the workplace structure also mediated the effects of Cobots on agency. In the first case (Uno Motors) Fordist technology and the presence of a union ensured that Cobots were deployed instrumentally. The second case (Duo Global Technologies) was one in which Cobots were flexibly deployed to meet changing production demands. The third case (Trio) went furthest in integrating Cobots into the production process as co-workers requiring new workplace relationships together with the potential to recognize new forms of agency.*

## INTRODUCTION

According to recent Pew survey data, the reaction of Americans to the increasing use of automation is decidedly mixed. While nearly 50 percent feel that the recent use of automation has done more to hurt U.S. workers almost 30 percent believe it has had no effect while only 20 percent think it has helped the average worker. On the other hand a future world of expanded job automation is viewed more pessimistically. Over three-quarters fear that automation will worsen income inequality while only one-third feel that it automation will expand the number of good, high-paying jobs (Chart 2). Finally, eighty-two percent of survey respondents believe that computers and robots will take over the majority of jobs over the next 30 years. However there is a strong NIMO – Not in My Occupation – effect as well since sixty-two percent of respondents felt that their jobs were safe from automation (Chart 3).<sup>1</sup>

Trepidation over the harmful effects of new technology on jobs and the quality of work life is not new. But the pace and manner of technological innovation suggests that people's beliefs about the threat of automation is not misplaced. Economists have estimated that about half of all current occupations have a high risk of computer automation (Frey and Osborne 2017). In the case of robots one study estimated that each additional robot introduced into the economy between three and six workers will lose their jobs and for those workers remaining employed wages will fall between one-quarter and one-half percent overall (Acemoglu and Restrepo 2017). On the other hand this assumes a static occupational landscape. New jobs and new tasks will be created through the use of computer automation and robotics.

This study presents three distinct cases examining the introduction of robots into auto assembly and parts production plants. It also highlights distinct challenges of and opportunities for using robots in each of the companies studied. Finally, the type of robot, known as collaborative robots or co-bots, introduced by each firm illustrates the way in which robot-human interaction is helping to re-shape the role of human agency in production.

Chart 1

**On balance, public says automation has done more harm than good for U.S. workers**

% saying, overall, the automation of jobs through new technology in the workplace has mostly \_\_\_\_ American workers

	Hurt	Helped	Neither helped nor hurt
All adults	48	22	28
White	49	19	31
Black	48	31	20
Hispanic	45	29	26
Ages 18-49	43	24	31
50+	55	20	25
HS or less	53	22	24
Some college	48	21	30
Bachelor's+	42	24	33

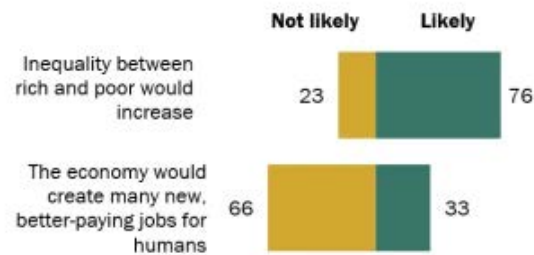
Note: Share of respondents who didn't offer an answer not shown. Whites and blacks include those who report being only one race and are non-Hispanic. Hispanics are of any race. "Some college" includes those with an associate degree and those who attended college but did not obtain a degree.  
Source: Survey of U.S. adults conducted Dec. 11-23, 2018.  
"Looking to the Future, Public Sees an America in Decline on Many Fronts"

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Chart 2

**Most say workplace automation will lead to more economic inequality**

% saying, if robots and computers perform most of the jobs currently being done by humans, it is \_\_\_\_ that ...



Note: Share of respondents who didn't offer an answer not shown.  
Source: Survey of U.S. adults conducted Dec. 11-23, 2018.  
"Looking to the Future, Public Sees an America in Decline on Many Fronts"

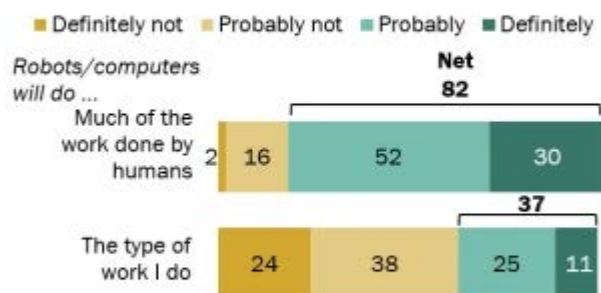
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Chart 3

**Public says robots will take over much of the work done by humans, but most workers don't think it will affect their own type of work**

*% saying, within the next 30 years, each of the following will \_\_\_\_ happen*



Note: Lower panel based on employed adults. Share of respondents who didn't offer an answer not shown. Figures may not add to subtotals due to rounding.

Source: Survey of U.S. adults conducted Dec. 11-23, 2018.

"Looking to the Future, Public Sees an America in Decline on Many Fronts"

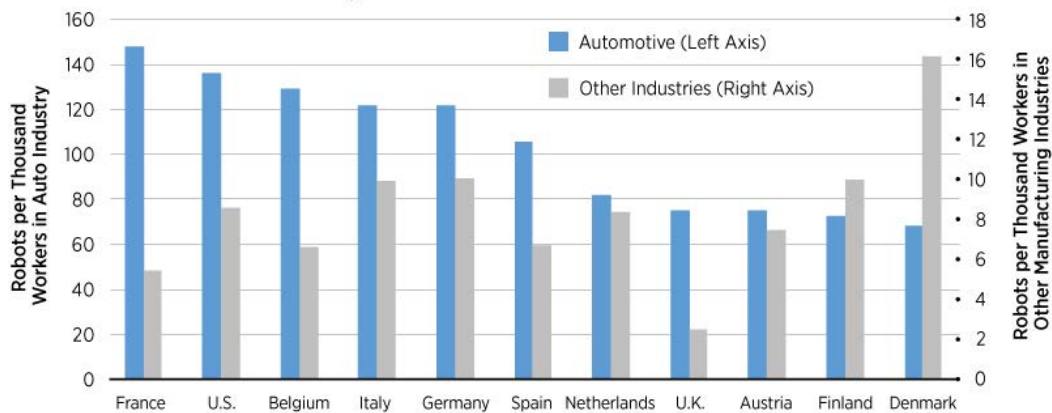
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An industrial robot is defined by the International Federation of Robotics as “an automatically controlled, reprogrammable and multipurpose manipulator for use in industrial automation applications (Bahradwaj and Dvorkn 2019). The term collaborative robot is intended to distinguish these automated machines from the large, powerful, dangerous and expensive robots that work in caged environments to closely restrict human-machine interaction. Cobots still require safety protocols that function through programmed limits on force and movement when humans enter their field of operation.

In the U.S. and across Europe and the UK industrial robots are found in the greatest numbers in the auto industry. While France has the greatest density of robots per worker the U.S. ranks second (Chart 4).

Chart 4

### Robots in Manufacturing: Auto vs. Other Industries in 2017



SOURCES: International Federation of Robotics, Eurostat, U.S. Bureau of Labor Statistics and authors' calculations.

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Given the prevalence of industrial robots in the auto industry it makes sense to investigate the use of robots on the ground. Our team conducted interviews with owners, managers, engineers and production workers at three automotive and auto parts producers in Southeast Michigan – the Greater Detroit region. In addition, one team member is professionally embedded in the supply chain through his work as sales and technology representative for BEHCO, a high-tech distributor selling Universal Robots – the leader in industrial Cobots globally. Furthermore, since the auto industry was one of the early adopters in the use and adaptation of robot technologies it makes sense to explore the ways in which robots are currently deployed in large, medium and small firms in the auto sector.

The business case scenarios depicted in these case studies begin to answer the following provocative questions, centered largely around the challenges of wastage created by a shortage of skilled production workers: What if a manufacturer could make their biggest warranty or quality issue go to zero defects? What if a company could get payback in a few months thereby allowing them to re-shore production from China? What if a firm deploys robots that are such integral part of the workplace culture that they the robots are given names and become team members?

Cobots, these new robots that are built to be safe working with people and easy to teach without writing programming code, are working in production every hour of every day across manufacturing. One of the co-authors of this paper has worked with Universal Robots – an industry leader in Cobot manufacturing - since 2013. The authors want to share stories about the business cases and impact the Cobots are making in production. The case studies are intended to help you understand the decision drivers, expected and unexpected benefits and risks that are managed in order to enable collaborative robotics applications.

Small, Medium and Large manufacturing companies are struggling with labor shortages with increasing pressure and problems associated with absenteeism and worker quality. Ultimately this is creating significant waste throughout processes and value chain. A recent report from Workforce Intelligence Network (WIN) in coordination with Michigan

WORKS and Oakland County government starts to quantify the costs associated with employee turnover. The subjective data was collected from member manufacturing companies, large and small. The data indicates the average time per employee working for a company as a Production Worker is 3 years and a General Labor is less than 2 years. On average, the cost per employee to hire, train and overcome inefficiency is \$6,000. Manufacturers are spending hundreds of thousands of dollars per year responding to the labor shortage. This hard to measure overhead, along with assignable benefits from automation are driving the demand for Cobots and automation in manufacturing.

Traditional robotics continues to offer solutions to the larger makers due to scale, cost and complexity being less of a risk. However these same risks are unmanageable by Small and Medium size companies, leaving them exposed to raising labor rates with limited supply and no real solution – until the rise of the Cobots. Large companies have found benefits, which we'll share, but the real impact has been with SME's that can now afford, control and leverage flexibility in their processes. The authors studied these company's decision drivers and talked to floor workers, engineers and senior management to learn why these are welcomed, how to socialize the Cobots and what the returns have been in Small, Medium and Large companies.

## THE CASE STUDIES

This case study involves three companies:

**Company 1** [Uno Motors]: Large multinational producer of cars and trucks in the U.S. and abroad. *Theme:* Agency (Task) Displacement

**Company 2** [Duo Global Technologies]: A small firm (less than 100 employees) supplying precision machined powertrain components. *Theme:* Agency Enhancement

**Company 3** [Trio]: A mid-sized company (200-500 employees) producing vehicle badges, arguably the most important symbol evoking corporate image, brand marketing and cultural and aesthetic value. *Theme:* Agency Expansion

### Case Study #1: Uno Motors

In 2014 one of the co-authors met with Dave and Frank, technical specialists for robotics and machine vision, and demonstrated the Universal Robot UR5 at their facility with 10-12 participants from engineering and management. It took only minutes to set up and power the Cobot, using the 110V wall outlet. The participants had never seen a Cobot demo before. Since this was a force-limited Cobot the demo did not require safety guarding. All the engineers moved away from the table, when the Cobot encountered an obstruction in its path – in this case a human being - the Cobot immediately stopped...all that was said was “wow”. That became a metric – “wows per meeting” - for judging the effectiveness of future demos.

The problem facing this company, and many large companies like them, was – how do I use this new tool without upsetting the company's culture? Getting robots on the floor with union-represented workforce was tried by another large customer and failed due to a lack of

trust on future use. Although this company has labor shortage issues, the potential gains were likely going to be constrained by labor-management friction. Ultimately, the production management has to own the tools and results – these Cobots are not guarded and were easily damaged. Given the history and risks, the company tried a few different uses while building a strategy to attack their largest problems in production – quality and warranty.

Starting with engine oil leak inspection, the Cobot was able to prove its value by performing inspection that wasn't feasible with people – finding miniscule droplets in a number of locations that change depending on the build variation. They went further to inspect the seating for electrical connections; again very difficult for people to inspect given the amount of connections and speed of the line. Using Augmented Reality (AR) to beam light on the failed connection, it can be quickly identified and repaired. They have a machine learning solution that enables the operators to be successful, saving tremendous effort in the repair stations where fixing the problem after body installation is very difficult due to access.

The results for the company have been summarized by Dave: “you have no idea how big of a deal this is for our company, we measured the before and after impact with our Mexico engine plant and our #1 warranty issue for failed body connections has gone to zero defects now for 3 months straight”. They now have these inspection cells installed at 6 plants globally for Powertrain with more plants in the queue. Most recently, an inspection cell was deployed at their flagship truck plant in Michigan – the first for vehicle operations. Two Cobots with vision systems run 6 different patterns for 650,000 different vehicle-build variations – measuring 65 quality inspection points in 25 seconds. When watching the line run with Frank during trials, the Cobot ran into a mis-assembled hose and immediately stopped with the force limited function. Frank said “This is really awesome, neither the vehicle nor the Cobot were damaged by the impact, I don't think we could use them if they did”.

The waste removed from these improvements will be targeted globally throughout their value chain for years to come. The team won a prestigious manufacturing award and continues to investigate waste reduction as a driving force for applications.

So robots with vision systems were effectively used to inspect for oil leaks. This resulted in fewer warranty claims and greater cost saving. These robots replaced inspection work in which human visual pattern recognition is mistake-prone due to fatigue and boredom. The cost of error can be \$7,000 per unit which is often all of the profit made from the vehicle. The workers perform general labor which means that it is low-value added work but high cost repair and remediation in a typical highly integrated assembly process. In today's labor market about 10-15% of these positions remain unfilled, mostly in the 2<sup>nd</sup> and 3<sup>rd</sup> shifts. The robot, by contrast, can work 24/7. On the other hand skilled laborers have a set of new responsibilities: robot maintenance and control.

#### *Agency and Automation in Case Study #1 - Historical Antecedents and Lessons Learned: Automation and Agency (Task) Displacement*

Of the three case studies the Uno Motors case is the only one to involve organized labor. It also represents an example of automation that displaces agency in the sense that tasks formerly requiring human vision are now being undertaken by Cobots. Automation that displaces human agency is often seen as a threat by those workers whose tasks are

eliminated. This is the basis for much production worker distrust of automation. It also conjures up the image of machine-breakers, Luddites. The term Luddite or Luddism is often associated with early 19<sup>th</sup> century workers who willfully and often violently destroyed machinery in the hopes of slowing down or forestalling technical change. One version of events suggests that the followers of mythical Captain Ludd were emulating the weaver Ned Ludd who took a hammer to 2 knitting machines in retaliation for being unfairly punished – he was whipped. Soon thereafter workers were blaming Ned Ludd for outbreaks of machine sabotage. “Destruction of a new type of machinery, which endangered jobs and reduced the standard of life of sections of the working class, is the best-known form of Luddism using this word now in a broader sense to describe all machine breaking...The long period of the Industrial Revolution when new inventions were applied piecemeal first to this industry, then to that, causing unemployment, dislocation and confusion in the older forms of industry caused a great deal of discussion. There was a ‘battle of ideas’ going on...” (Munby 1971, 33).

Opposition to machine production took different forms in different countries. In the late 18th century a precursor of supply-side economic policy involved wealthy feudal families and aristocrats receiving special exemptions from taxes, regulations and traditional craft worker protections in order to promote the creation of industrial enterprise zones in the French textile-producing region of Normandy. The goal was to encourage the production of high quality fabrics which could then be exported at lower costs. This allowed for the introduction of spinning machines which could produce low-cost, high-quality textiles without the need to hire craft workers. The Norman workers, the majority of whom were women, saw their wages fall due to the lower cost of using machines. One spinning machine or frame could do the work of 100 workers (Horn 2012, 177). As one writer at the time exclaimed, “These fine machines will enrich a few individuals, but will ruin a whole country” (Manuel 1938, 181).

In 1789, workers, faced with unemployment, reacted by taking to the streets, marching on manufacturers with the intent of destroying their spinning machines. Pitched battles were waged, machines were burned and employers and police retaliated by killing many of the protesters (Horn 2012, 179-183). But upon further examination this was not a single-minded reaction against machinery. These workers opposed the new machinery because it denied the possibility for alternative technologies – alternative machines – that could be used to complement the skills of the workers and create an economy based on fair prices not the lowest possible price along with employment for all who wanted work and decent wages. Instead of export-led growth, workers argued and fought for system of production that first and foremost met local needs thereby preserving employment by adopting machine technology that worked with laborers (Horn 2012).

Approximately 30 years later British workers rose up against the real threat of starvation resulting from both the elimination of state protections like the minimum wage and the introduction of labor-replacing machinery. These workers, Luddites, engaged in numerous acts of destruction of machines and raw materials partly as a way to disrupt the industry in order to obtain better wages – what one historian called “collective bargaining by riot” (Hobsbawm 1964, 7). Rather than portraying these industrial actions as parochial, ill-conceived and ultimately futile measures that merely forestalled the inevitable adoption of machinery we could instead appreciate and take seriously their vision technology involves restructuring workplaces and resetting the roles and relationships between employers and

workers, workers and technology and employers and technology. In these historical examples workers wanted to preserve a set of traditions and values that represented a fairer, more humane, moral economy (Thompson 1966 1971). So, new technology itself was not the enemy. Rather the question was how machines could be embedded in a social system of production in such a way that human agency would be engaged and valued. Likewise these case studies highlight the many different organizational and cultural responses to the introduction of in this case robot technology with respect to agency.

Another dimension of the agency-automation dyad is illustrated by the prospect of a workerless automobile factory. This vision of a fully automated assembly plant extends back to the 1950s when automated machines were being introduced into factories in the Midwest. The Cleveland-area Brookpark engine plant was targeted for large-scale automation. The autoworkers' union, the UAW, saw this as a direct threat to their membership. Those workers who were employed in the automated factory had to shift their work away from the skilled tasks involving machine set-up and operation – tasks that allowed them control over the pace and intensity of work – to little more than assistants controlled by the dictates of the machine. This specter of technology-driven work and technological unemployment occupied union members attending the annual meeting of the UAW in 1954. It was argued that the automated manufacturing plant was threatening to “create a social and economic nightmare in which men walk idle and hungry, made obsolete as producers because the mechanical monsters around them cannot replace them as consumers” (Meyer 2002, 73). Here we have a 20<sup>th</sup> century fear of technology as displacing human agency altogether on the shop floor.

Today, faced with the growing number of tasks being outsourced to non-human devices, the threat of automation as an agency displacing phenomenon is once again upon us. Yet, the corporation is working with the union to mitigate the *worker displacement* effects of *task displacement*. The Cobots used in this case study replace human vision with computer-aided vision and augmented reality (AR). This enhanced visioning capacity improves inspection quality. While the task is displaced from human to machine the task performance itself is improved. Employment losses due the widespread introduction of automation, like Cobots, is inevitable according to Brad Markell executive director of the Industrial Union Council for AFL-CIO in Washington, DC. What matters is that employees retain a voice in how the technology is used and are given training and access to the higher-quality jobs that might be created by the robots' introduction (Elejalde-Ruiz 2018). To the extent that new tasks are created in the process worker displacement can be avoided. So, in May of 2019 Uno Motors announced the creation of a technical training center. This center will train workers in collaborative robot technology and advanced vision systems. This case study both clarifies and complicates our understanding of agency and automation.

## **Case Study #2: Duo Global Technologies**

Duo Global Technologies was shopping for their first Cobot in 2014. When looking at the challenge of needing to be competitive in the global market, Duo, like many small manufacturing companies, struggled to find benefits from traditional robots. Traditional industrial solutions are delivered ‘turn-key’ by Integrators that end up having control over the process as they write the code to integrate the tools and process with the parts being manipulated. With fixed infrastructure that is difficult to change this is an expensive option

and, as a result, most small companies are not interested in that approach. Duo was looking for a flexible tool that could be easily programmed and safe to work with on the floor.

The lead manufacturing engineer, Ryan, had no prior robotics experience but was well versed in machine controls. With training and support they were able to deploy 12 Cobots over 4 years and have a positive impact on their business. The ROI for their first Cobot was made in 4 months. Duo has made great strides largely because they have complete control over the tools. Frequent change-over is not an issue because they simply unplug, move and reprogram their Cobots for a new job. Output on the large multi-shift projects went from roughly 1600 parts/day to 3400 parts/day by increasing cycle time (handling hot parts is no problem for the Cobot) and running a 3<sup>rd</sup> shift with 'lights-out'. Over the past few years they've been able to re-shore production to Michigan since they are now more competitive than exporting from China.

Ryan, the lead engineer, explained "The cost savings was much more than the direct labor, by using an automated system with imbedded QC inspection – our Indirect Labor is greatly reduced since the data is machine driven and our technicians work on analysis and problem resolution". When reflecting on the strategy that's lead them from no robotics to a semi-automated production floor, Ryan also noted: "We would be out of business right now if we didn't take these actions – the trade war would have sunk our boat if we didn't balance our production for local supply". It was also key to note that Ryan has since trained the production team and maintenance team on the programming and functions – they are now in charge of the process and future installations and Ryan was promoted to VP of Sales and Engineering.

#### *Agency and Automation Case Study #2 – Historical Antecedents and Job Enrichment and Agency Enhancement*

The mid-20<sup>th</sup> century adoption of automation mirrored the rise of Fordist mass production. Fordism emerged as an economic system out of the need to produce vehicles in large quantities using standardized parts thereby lowering unit costs and increasing consumer market demand. Machines were dedicated to a single purpose – e.g. stamping metal – and workers were similarly deployed throughout the factory at fixed intervals along the assembly line to assemble various parts of the car. If a machine could be introduced to perform the same task that individual worker performed and the cost of the machine, amortized over the length of the production run or level of output, was lower than the cost of hiring, training, supervising and employing workers the machine would be adopted. Fordism constituted a straight-forward example of agency displacement: using automated machine processes to substitute for human labor. In those tasks in which safety and health of the workers was a serious and ongoing concern – e.g. welding at angles that put strain on the worker's body or painting that required respiratory equipment – the union welcomed the introduction of technology as long as the machines were dedicated to performing a single unsafe, unhealthy task. This recent account of the early days of the introduction of robot co-workers in an auto plant illustrates the role of task displacement without worker displacement as was illustrated in the first case study:

The inventions introduced by Northwestern and UC, Berkeley had first put GM's employees on edge. Workers were concerned that their jobs might get replaced by

the robots Colgate, Pehskin, Akella and their colleagues were developing. However, as experimentation continued the early cobots began to change their perception for the better.

“The assembly line workers really appreciated that it was not a robot looking to replace them,” Peshkin said. “Because it was collaborative and because their human skills were going to continue to be needed to work with this cobot, it helped them do their jobs with less risk of ergonomic injury. They were smooth, quick, responsive and agile, so they were appreciated.” Some of the prototype cobots quickly became recognized as essential by assembly line workers. (Pittman 2016)

As the global auto industry became more competitive and consumer demand diversified technological demands also shifted away from standardized high volume product runs. Instead more frequent re-tooling for model changes required the use of more flexible labor and machinery. Workers were expected to monitor and control machinery. The movement toward flexible specialization and lean production began to transform the industry in the later quarter of the 20<sup>th</sup> century. In some cases this had the effect of enhancing human agency by giving workers more voice in the production process – although there was no guarantee that these additional voices were always listened to – and more control over the machines that they worked with.

Likewise, in this second case study, the introduction of collaborative robots has created new work and new occupations for plant personnel. In particular the industrial engineer can take over responsibility for programming. In addition the new occupation of robotics engineer involves a number of unique tasks that emerged out of the introduction and diffusion of robot technology. Among these:

- Review or approve designs, calculations, or cost estimates.
- Debug robotics programs. Build, configure, or test robots or robotic applications.
- Provide technical support for robotic systems.
- Design end-of-arm tooling.
- Supervise technologists, technicians, or other engineers.
- Integrate robotics with peripherals, such as welders, controllers, or other equipment.
- Install, calibrate, operate, or maintain robots.
- Conduct research into the feasibility, design, operation, or performance of robotic mechanisms, components, or systems, such as planetary rovers, multiple mobile robots, reconfigurable robots, or man-machine interactions.
- Document robotic application development, maintenance, or changes.
- Write algorithms or programming code for ad hoc robotic applications.<sup>2</sup>

Similarly, the new occupation of robotics technician arose to meet the needs of companies that install and maintain robots. Their tasks include are:

- Make repairs to robots or peripheral equipment, such as replacement of defective circuit boards, sensors, controllers, encoders, or servomotors.
- Troubleshoot robotic systems, using knowledge of microprocessors, programmable



controllers, electronics, circuit analysis, mechanics, sensor or feedback systems, hydraulics, or pneumatics.

- Install, program, or repair programmable controllers, robot controllers, end-of-arm tools, or conveyors.
- Maintain service records of robotic equipment or automated production systems.
- Perform preventive or corrective maintenance on robotic systems or components.
- Build or assemble robotic devices or systems.
- Assist engineers in the design, configuration, or application of robotic systems.
- Install new robotic systems in stationary positions or on tracks.
- Program complex robotic systems, such as vision systems.
- Develop robotic path motions to maximize efficiency, safety, and quality.
- Fabricate housings, jigs, fittings, or fixtures, using metalworking machines.
- Maintain inventories of robotic production supplies, such as sensors or cables.<sup>3</sup>

The work environment of the robotics engineers and robotics technicians requires a lot of personal interaction. Eighty percent of robotics engineers and seventy-seven percent of robotics technicians surveyed by the Department of Labor report having face-to-face conversations every day, over ninety percent use e-mail daily while sixty percent (robotics engineers) and fifty percent (robotics technicians) communicate by phone every day. This work environment differs from the traditional Fordist assembly line in which task specialization demanded little or no communication between workers and in some cases penalized workers for interacting with one another.

### **Case Study #3: Trio Manufacturing**

Trio Manufacturing engaged with Cobots in 2013 as they were seeking a solution to their extreme labor shortage and resulting capacity constraints and stressed culture. Trio leads the market in decorative badging and their design knowhow and molding capabilities are revolutionizing the market, leading to expansive growth. Yet twice a day, the bus from 50 miles away arrives with temporary workers. An unreliable local workforce and labor shortages was leaving 10% of the molding machines un-manned and not running. This required unscheduled weekend overtime which the majority of long standing employees did not want.

Trio's commitment to a collaborative robotics strategy was significant. Two direct hires of robotic technicians work with a lead manufacturing engineer to design, build and deploy Cobot automation systems doing a variety of material handling (packaging) and fabrication applications (gate removal). Given the known business issues by working mandatory overtime, the production operators adopted the Cobots as teammates, in some cases naming them: "We like the Peanuts gang, this one is Lucy." It is not surprising therefore that the human worker-Cobot team is working together in production cells with part-to-part interaction. The key is the ownership the production team takes in the output. Most every production supervisor can power up and start the programs. Many are able to evaluate the fault codes and correct for minimal down time. Jason, a Molding Supervisor with 12 years on the floor notes "I can do some basic things like change the program and recover most errors, but we have 3 technicians on every shift if more help is needed." Dorothy, a Team

Leader with over 5 years' experience, added "I hit a button and it [Lucy] gives me a part for quality inspection" thereby illustrating how easy it is to interrupt the process, finish the work and keep production running. In response to the question "What is the role of the production workers related to the use of Cobots?" Sean, the Sr. Process Engineer for 19 years noted "most applications come to the floor with new business," however Jason commented, "If we see something working in one area of production, we want to use it in our department." So continuous improvements are constantly evaluated and shared for best practices. With more than 20 Cobots running machines and processes every day they have become integral to the results.

In response to the questions "Do you feel safe? And do you think Cobots will take your job?" With respect to safety, all installations are following the guidelines from their Safety Risk Assessment however Dorothy's comments reinforce a strong company culture: "I feel safe, I know my company and co-workers will make sure I don't get hurt." As for Cobots being threats to employment, Sean emphasized "arguably we are in one of the tightest labor markets in Michigan. We have to bus people to this area for help – no one is losing their jobs." Nevertheless with a large tier-one plant less than a mile away regularly offering workers more money in effort to poach local labor, Sean knows he is going to battle the labor issues for some time to come. Jason stated "I've been working here since the first Cobot was launched, no one has lost a job to a Cobot, we reassign them to other work in the plant."

In response to the question "How do Cobots impact your job?" Dorothy explained simply "They make it easier; they are reliable and predictable...however there's one Cobot that that works pretty fast and I have to keep an eye on that cell." Molding cycle times and cavitation are variable, keeping the finished goods and empty packaging moving into and out of the cell is the role now for the operators and Team leader in that area. Jason noted, "I can plan the operator schedules and part production plans without concerns. We've stabilized our processes with 15 of the presses now fully automated." And Tyson, a Production Operator for over 13 years noted "I got this new promotion specifically because of the Cobots and my interest." Collectively, they stated "we make more money!" as Sean explained how the company recognizes the effort and skills being developed and wants to build on the momentum by reinvesting in the people and processes that are making a difference. Asked what would happen if they went back to the old days Sean said, "No one would like to see them [Cobots] go. It's clear they are helping the business doing the dull and dangerous jobs that most people struggle with."

What makes the Trio experience so powerful isn't just the improved culture and open capacity but the creativeness associated with controlling the technology which has lead to unexpected benefits. Decorative badging has to be flawless since the badge both conveys the corporate image often enhancing the social status and image of the vehicle owner. In the auto industry, historically, badges were a symbol of social capital and cultural. The process of badge making today requires a molded plastic part to be chrome plated before final assembly. Unfortunately, flaws in the molding process are only identified after plating, creating a large scrap problem both in terms of cost and environmental impact because no rework is possible.

The engineer and technicians at Trio devised a solution using inductive heating elements to heat the cavities in the mold while parts are being removed. Connected to the Universal Robot (and behind a guard due to safety), the Cobot positions the elements for a specific

time then retracts from the mold before it closes to make the next flawless part. Hot molds result in better mold flow and elimination of knit lines which create the failure. Sean confirmed “we fixed a major scrap issue, there was about 10% fall-out...with the Cobot solution we are less than 2%. Scrap cost about \$1 for molded plastic and \$5 for the chrome plating – so this is a big impact.” Higher quality, major scrap cost reduction, higher output and level production throughout the week has all been achieved by a self-directed team.

Finally, when asked “How do Cobots impact your company?” Sean stated, “[I]n automotive our customers expect annual cost reductions to remain competitive. With the Cobots we can do that AND reinvest in our people”. Adding “steady growth and reinvestment has allowed us to open up more technical roles that people want to work in”. Sean’s point is consistent with our findings at other customers, elevating the perception of work on the floor changes the paradigm to an Advanced Manufacturing facility. Because the technology is accessible through logical programming/teaching interface – those without programming language experience can engage in the automation and bring more value than the physical aspects of work. Larry, one of the Robotic Technicians with 8 years on floor emphasized “we won a new customer because of Cobots were the technology they wanted to see us use. They were looking to incorporate themselves and now have a partner to learn from”.

In this case study the team consists of senior management investing in people and tools, engineering taking a lead by fixing the problems that impact the business the most, and the production team owning daily production and recommending future use. Ultimately this equation results an approach to automation that integrates robots into the team production process. It is best summed up by Larry the technician: “I never programmed robots or built automation before this job, now I’m able to do that in a matter of weeks and it matters to our management. I can only imagine what we’ll do next.”

### *Agency and Automation in Case Study #3 – Automation and the Expansion of Agency Beyond Humans*

There is no single outcome, no one size fits all result emanating from the adoption of automated machines, robots, co bots and artificial intelligence. New technology is surely displacing human agency in the performance of man routine, standardized, rule-based tasks. But robot technology also can have the effect of enhancing human agency and even extending our ideas and imaginations about what constitutes agency.

In analyzing the human element from different social science perspectives we can recognize that economics understands human action in the purposive, rational individual agent. In sociology human activity takes place through the creation of systems shared meaning with other human agents, for example Alfred Schutz’s idea of the lifeworld. The critical theorist and sociologist Jurgen Habermas distinguishes between these two realms of human agency through his use of the phrases system and lifeworld. The system is the world of goal-oriented actions in which individuals utilize nature and technology – and sometimes other people - as a means to an end. So technology is literally and figuratively a tool to be used to accomplish a task. Robots can be conceived as tools to be used (programmed) to accomplish discrete tasks (moving a bin of parts across the warehouse floor to an exact spot). With the introduction of collaborative robots and artificial intelligence we can begin to discern an element of meaning making in the programming and deployment of technology.

Jürgen Habermas not only identifies two separate spheres of human activity – system and lifeworld – but he also makes the bold argument that the two spheres are guided by different types of rationality (Habermas 1987). Heretofore rational action was understood to encompass means-ends behavior. I do this in order to accomplish that. Why did a company adopt new technology? Because new technology best fulfills the goal of the company: profit maximization. The goals themselves might change depending on which agent of the company we are concerned with. For instance the newly hired CEO might have the goal of increasing the share price and dividend payout which goal may or may not align with profit maximization.

Elements of these two types of industrial production remain today. They mirror in some ways a dual logic of human agency comprised of (1) instrumental action and (2) communicative action. Instrumental action is exemplified by the Fordist case in which machines are used strictly as a means to an end. Spot welding can be better (more safely and inexpensively) accomplished by welding guns attached to automated mechanical arms than human welders. Communicative action, by contrast, requires human interaction. The goal is that we understand one another, not that we agree, but that we are able to interpret what the other person means to say or do. Flexible specialization, best illustrated by team production, makes use of communicative action for its success. The requirements for understanding one another are: comprehensibility, legitimacy, sincerity and truthfulness.

*Comprehensibility:* Is the agent using actions, words, language, phrases, jargon, symbols that make sense to me? This is the foundation of communication. In the absence of translation devices there cannot be effective communication.

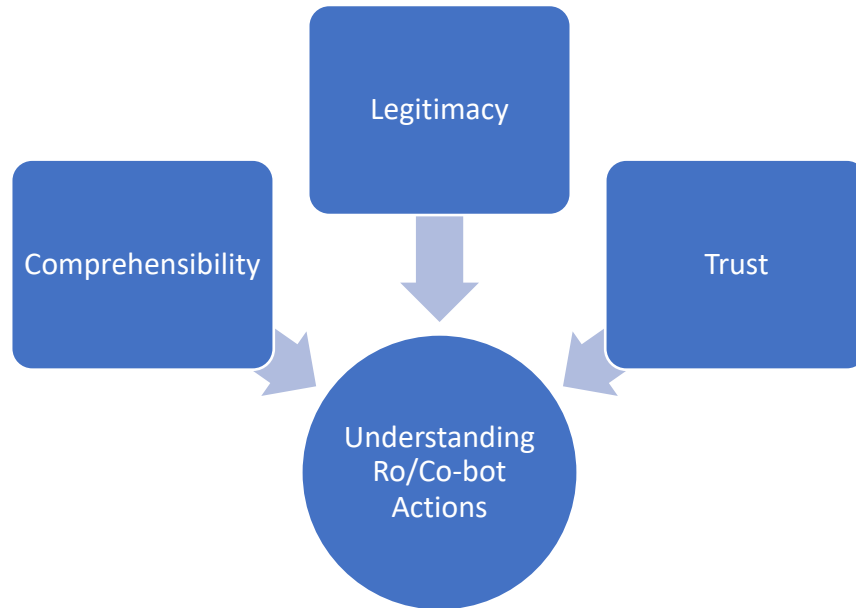
*Legitimacy:* Does the agent have the proper credential, standing, personal history or lived experience to say what they are saying? For example, someone prescribing medication or advising on a surgical procedure without a medical license lacks the legitimacy to elicit actions that conform to such medical statements.

*Sincerity:* Does the agent mean what they are saying/doing? We can question the sincerity of someone by asking “Are you joking?” “Do you really feel that way?” At the end of the day we respond to them – or not – based on our own assessment of their sincerity.

*Truthfulness:* Does the agent have the information or facts necessary to make/take the statements/actions they are making/taking? Fact-checking has become a full-time occupation for many in the media where untruthful public statements seem more commonplace. This lack of believability or trust in the veracity of another’s actions undermines the ability to understand one another.

In the case of robot-human interaction sincerity and truthfulness can be thought of as trust. In other words robot actions are sincere in the sense that they map onto expected behaviors and truthful robots are machines that act and move in ways that align with the given information available to it. In turn, trust is associated with confidence in the quality of the information produced by the robot. So we can collapse sincerity and truthfulness into trust. Figure 1 illustrates the components of ‘communicative’ action involved in human-robot meaning creation and interaction.

**Figure 1: Requirements for meaningful human-robot interactions**



Schaefer, Chen, Szalma and Hancock (2016) identify 3 main categories of the trust relationship: (1) Human Factors (demographics, personality, cognitive and emotional factors); (2) Partner-Related and (3) Environment-Related. The partner refers to the robot/cobot. The partner-specific factors affecting trust include:

- Mode of Communication – human speech is more trusted
- Appearance/Anthropomorphism – human appearance increases trust
- Level of Automation – “individuals exhibit greater trust in automation that provides some level of collaboration. For example, users typically trust manually adjustable automation when it provides explicit control (i.e., the human has the authority over system function allocation), compared to implicit control (i.e., the system is given the authority); individuals prefer automation that can learn, recognize, and respond to personality differences” (Schaefer, Chen, Szalma and Hancock 2016, 383)
- Intelligence – capacity for learning and adaptation based on feedback
- Personality – ability of robot to adjust to user personality

In the 21<sup>st</sup> century the question is now whether robots, AI and automated devices like driverless vehicles have entered the world of communicative action as agents in their own right.

Humans...therefore become partners, not just “users,” and the relationship between human and robot is not unidirectional (or absent) anymore, but depends on both the interacting agents. We posit that for this dynamic equilibrium to work

and for it to bring the expected benefits, robots will have to become more humane, so as to establish an effective mutual understanding with their partners and carry part of the effort needed to maintain the interaction (Sciutti, Mara, Tagliasco, Sandini, 2018, 24).

Cobots in the workplace allow us to expand our notion of agency in such a way that “agency is decoupled from criteria of intentionality, subjectivity, and freewill” (Sayes 2014, 141). The actions of human workers change based on their relationship to their robot co-worker. “The perspective asks that we remain open to the possibility that nonhumans add something that is of sociological relevance to a chain of events: that something happens, that this something is added by a nonhuman, and that this addition falls under the general rubric of action and agency” (Sayes 2014, 145). So the third case study of Trio moves us along a road in which agency is expanded to include non-human actors.

## CONCLUSION

The three case studies presented in this paper and presentation reveal that there is no singular effect of automation on agency. In the case of Uno Motors (Case #1) the use of Cobots to visually inspect for leaks and clip placement using augmented reality (AR) technology replaced human eyes for this particular task. Not only are Cobots not prone to human fatigue resulting from the monotony of scanning for defects but the quality of inspection improved through the use of AR. The result was a reduction of costly customer warranty claims to near zero, saving the company up to \$7,000 per unit sold. The authors describe this as a case of task – as opposed to worker – displacement. The displacement of tasks formerly completed by workers allowed the company to shift workers to other tasks such as Cobot supervision and programming. Here Cobots are used in an instrumental way to meet needs of a high-volume mass producer much like most expensive, dedicated, single-purpose capital goods have traditionally been used in manufacturing.

At Duo Global Technologies (Case #2) the move away from using outside integrators to program and deploy robots to meet the production requirements of the customer meant that Cobots were used flexibly to solve a variety of manufacturing needs as they arose and as the plant staff gained skills in programming and controlling the Cobots themselves. The flexible use of Cobots at Duo reflects the flexible specialization system of manufacturing that became an important part of the customized specialty manufacturing link in the automotive supply chain. The result for worker agency at Duo was to enhance their role in the production process by increasing the need for robotics engineers and robotics technicians, partly obtained through up-skilling the current workforce.

Finally, the case of Trio (Case #3) illustrates the collaborative dimension of Cobot-human interaction. Specifically the Cobots at Trio are trusted, responsible co-workers. They are team members that are given names (Lucy, in the example above). The use of Cobots in this case begins to complicate the definition of agency. Cobots need to communicate their “intentions” - regarding, for instance, range of motion, direction, speed and force of motion – in order to make them understandable to their human co-workers. Their actions must be comprehensible. Workers need to be able to trust the intentions of the Cobot. And finally Cobots need to be recognized as legitimate co-workers with actions that align with the goals of safety, predictability and efficiency. These fundamentals of comprehensibility, trust and

legitimacy map closely onto Habermas' theory of communicative action as action oriented to understanding one another.

In these three case studies the trajectory of human-robot interaction is illustrated through human agency task displacement; human agency enhancement and human with robot agency in collaborative production. This tracks the historical development of human-machine interaction in manufacturing through high-volume mass production through flexible specialization. It also illustrates forms of rational action from instrumental action to communicative action in which mutual understanding is the desired goal.

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## PechaKucha and Papers Session

### Locating Agency

Curators: Chris Golias (Google) & Tania Lewis (Digital Research Centre, RMIT)

This session illustrates the powerfully nuanced, located and embedded insights that ethnographic research can bring to questions of agency and technology, whether in relation to drives to scale-up and/ or generalise technology or in terms of moments of resistance to technologically-driven ‘solutions’. We venture into the world of Indian LGBTI dating apps, spend time with innovative Himalayan villagers and with sustainability-oriented, Alexa-style household gadgets, get a glimpse into Chinese urban laundry drying practices that resist the drive to technology, and head, quite literally, into the field with Australian farmers engaging with automated agricultural systems.

In casting a critical eye on technology and automation, these diverse papers highlight equally diverse, human and more than human, examples of actors and agency, and the inherently collective nature of socio-technical action. The different—often ‘weirdly’ unfamiliar— structures and systems of agency that unfold in these papers also speak to the need to step back from common sense conceptions of, and myths around, ‘smart’ practices, homes, and cities—to challenge the easy conflation of smartness and progress with automation. Finally, these papers ask how to *relocate* agency, that is, to understand the ways socio-technical practices are always complexly embedded—in places and environments, cultures, habits and rituals, knowledges, bodies and things.

## Out to Dry

### Change and Agency across Urban China

ZACH HYMAN, EPAM Continuum

*This PechaKucha will take the audience on an intimate, visual exploration of the evolving ways that clothing is dried outside across urban China as drying practices are forced to adapt to limitations by evolving regulation and perceptions of urban modernity. Increasingly, engaging in this social practice requires an act of agency against both municipal governments and one's own neighbors in China.*

*While drying one's laundered clothing outdoors remains a standard part of rural life, both the legal and physical space for this practice has shrunk during China's massive urbanization. This practice is being replaced by bureaucrats' desire to stimulate domestic consumption (of appliances, in this case) and their desire to erase from cities what is considered a visual embarrassment of laundry hanging out of windows and between buildings.*

*Today when something in urban China needs drying outside of one's privately owned space, one must assert agency over a slice of public space: A comforter is draped over a chair in a quiet, sunny corner of an apartment courtyard, or towels and sheets are thrown over a rope running between a signpost, a stop sign, and an electrical pole. While the scales and dried objects vary, the declaration of agency remains.*



"Towels Drying on a Dockless Bicycle," © Zach Hyman

## Ethnographic ‘Weirdness’ Attending to Indicators of the Unfamiliar

CHARLEY SCULL, *Filament Insight & Innovation*

*This presentation begins with ethnographic research of an Indonesian tuna fishery in which a field partner describes unfamiliar cultural behavior as ‘weird’. Using that moment as a starting point, the paper then undertakes a reflection on the usage and meaning of the term. It explores ‘weirdness’ through a range of core tenets, like cultural relativism, empathy and ethnocentrism and then plays with the meaning of weirdness across a number of disciplinary and market lenses. The talk builds to a provocation about the ways in which ‘weird’ can serve as a call to action. It concludes that researchers should use ‘weird’ as an indicator that helps them know where they need to dig deeper, in search of empathic understanding and where they need to reconcile their biases. By doing so, the talk argues, we are giving agency to the data which we don’t yet understand.*



“Crew of the Berlian” ©Charley Scull

**Charley Scull** is a visual anthropologist, ethnographer, insight strategist and UX researcher. He has worked in consumer insights, design and innovation, and product development across a range of industries and global marketplaces. Key areas of his work have explored healthcare, brands and advertising, green place-making, sustainable seafood supply chains, and the future of mobility. His camera remains an important tool in his ethnographic toolkit, which he uses whenever the budget allows for it and sometimes when it doesn’t! Charley holds an MA in visual anthropology and a PhD in cultural anthropology from University of Southern California. [charley@filamentinsight.com](mailto:charley@filamentinsight.com)

## Nangi Village

### A Story of Collective Agency in the Mountains of Nepal

EMELIA RALLAPALLI, *Pebble Strategy*

*What can a remote Himalayan community teach us about innovation? Emelia's Silicon-Valley-first-world frame of reference is the dominant lens of her work. It's the place where we buy into technology's promise to help solve the world's problems. But it's also ground zero for a dystopian future where humans are automated out of relevance.*

*In this PechaKucha Emelia will explore the ways Nangi Village, with the help and leadership of one member in particular, is using technology and innovation to increase its collective power for its own goals of educating its young, connecting to the world, and driving its own economic development. This talk will also be a personal meditation on Nangi's impact on her own perspectives regarding human agency, problem solving, and innovation.*



“Moment of Shanti,” © Emelia Rallapalli

**Emelia Rallapalli** Emelia is a brand strategist, researcher, and founder of Pebble Strategy. She consults for some of the world's most influential brands. [emeliam@pebblestrategy.com](mailto:emeliam@pebblestrategy.com).  
Twitter @ERallapalli  
Medium @emeliam

## Designing Queer Connection An Ethnography of Dating App Production in Urban India

VISHNUPRIYA DAS, *University of Michigan*

*India is currently at the precipice of immense social and technological change. The proliferation of smartphones and growth of the nation's app economy raise questions about how digital platforms might influence the contours of love, sex, and desire in the region in the coming decades. This paper engages with these concerns by examining what it means to design intimate connection for LGBTQ communities in non-western spaces. Drawing on fieldnotes, app walkthroughs, interviews with mid-level and upper-level professionals in the dating app space as well as audiovisual material from advertising archives, this paper provides readers with a critical analysis of the "problem" of designing queer connection in a digital world of abundant data and transient identities. Carefully examining the production practices of Delta, India's first locally produced LGBTQ dating app I argue that there is a pressing need for scholarship on industry dynamics beyond western technology centers.*

### INTRODUCTION

The winter air was still crisp, but the late morning sun felt pleasantly warm on my skin as I sat in an auto, speeding along the wide tree-lined roads of Lutyens Delhi<sup>1</sup>. It was Valentine's Day weekend, and I was making my way to the center of the city to attend a queer cultural event titled 'Gaylenties Day.' The event was organized by a Delhi based youth group in partnership with *Delta*, the first (and only) dating app specifically targeting the Indian LGBTQ community. The six-hour long Gaylenties Day extravaganza was aimed at Delhi college going students<sup>2</sup> and consisted of short plays, drag performances, open mic shows, and an in-person speed dating event coordinated by Delta. Founded in Fall of 2017, the app was the culmination of its founder Ishaan Sethi's goal to create a dating community for queer Indians. In the opening remarks for the event, an upper level executive present, began by describing Delta's vision and mission saying –

*"As Delta we are the first LGBTQIA+ dating app in India that is homegrown for and by Indians. Today we have grown to a community of over sixty thousand users from all sorts of backgrounds. From all sorts of identities, and every single day we are growing more and more"*<sup>3</sup>

These words simultaneously emphasize the cultural specificity of the Indian queer experience and the app's commitment to catering to the romantic and sexual desires of individuals with varied sexual orientations. The choice to target the entirety of the LGBTQ spectrum stands in distinct contrast to industry norms where most non-heterosexual dating apps focus on a specific niche, most often gay men, as their core user base (Murray and Ankerson 2016). In addition, it implicitly suggests that there is something unique about local sociocultural dynamics in India that international dating apps popular in the country are not addressing. Therefore, in this paper I examine how Delta constructs digital categories and incorporates affordances of smartphone-based dating platforms to try and provide agency to Indian queer users searching for intimate connections. Analyzing the ways in which a unique

player in an evolving dating app ecosystem approaches notions of “queerness” and “Indianness” is an avenue to explore broader questions regarding human agency, queer identity, and technology affordances.

### **Approach: Queer Theory Meets Media Industry Studies**

In this paper, I incorporate perspectives from Critical Queer Theory and Media Industry Studies. Scholars of Queer Theory such as Dean (2000), Giffney and Rourke (2009), Lowe (2015) and Puar (2018) emphasize the importance of critically examining structuring forces of institutions, infrastructures and historical legacies while recognizing the place for individual agency through play, creativity, and resistive performance. This makes it a useful analytic approach to engage with ideas about sexuality outside the realm of individuals and into the realm of industries, without being drawn into the quagmire of binary debates about technological determinism (or lack thereof). Queer Theory has been used to critically examine the new mobilities McGlotten (2013) and changing spatiotemporal relationships Baudinette (2018) arising from our everyday interactions through dating apps. However overall, research on dating platforms<sup>4</sup>, both globally and in the small number of India specific studies, tends to focus on user experiences (Albury et al. 2017; Dasgupta 2018) and/or platform affordances (Shah 2015; MacLeod and McArthur 2019; Ferris and Duguay 2019), leaving a critical cultural analysis of dating app industry production relatively unexamined. The handful of empirical qualitative studies on the industry dynamics of queer dating apps, such as Murray and Ankerson’s (2016) research on the production of sociality through the design decisions of the founder of the lesbian dating app Datch<sup>5</sup> and Wang’s (2019) exploration of labor practices involved in livestreams of Chinese gay mens dating app BlueD, show that industry dynamics can be extremely rich sites of analysis to understand the construction of queer possibilities through digital design.

Despite India being one the fastest growing mobile phone app economies in the world (Mitter 2019; Mandel and Long 2019), there have been little to no ethnographic studies on Indian app production cultures. In contrast, there is a long history of ethnographic academic research on the advertising (Mazzarella 2003), film (Ganti 2012) and television (Kumar 2010) industries in India. Insights from this body of work highlight how analyses of media/tech cultures can make compelling claims about the evolving nature of globalization, citizenship, modernity, and identity politics. Therefore, in this paper I draw inspiration from ethnographies of production cultures within established screen/media industries but shift the site of study to emerging digital mobile app industries. Noting the significant lack of research on app production cultures beyond Silicon Valley centers, the paper concentrates on examining how “queerness” becomes a product/experience accessible through digital platforms in India. To do this, I draw on a mixture of in-depth interviews, ethnographic observation of industry events and a curated archive of digital material (Ex. advertisements, magazine reports, app walkthroughs)<sup>6</sup>. I collected primary data (participant observation, interviews) during eleven months of fieldwork across the cities of Mumbai, Bangalore, and New Delhi within the corporate offices of dating apps and ancillary industries operating in the country<sup>7</sup>. Information that Although I integrate insights from qualitative data gathered across this time period, the majority of this paper draws on information gathered during four months (November 2018 - March 2019), when, following the Supreme court verdict



decriminalizing homosexuality on 6th September 2018, dating apps began to more explicitly target the Indian queer market<sup>8</sup>.

## **“INDIA’S FIRST DATING APP FOR THE LGBTQIA+ COMMUNITY. FOR INDIANS. BY INDIANS”**

Taking Delta as a specific case that reflects broader industry issue, I first analyze corporate imaginaries of ‘queerness’ and ‘Indianness’, paying attention to the vision of company founders and funding pressures surrounding the early development of the app. Doing so, I identify five key challenges involved in producing a dating platform for users across the LGBTQ spectrum given the specific regional history of homosexuality in India.

### **Imagining Queerness**

Winter in Delhi is a time of smog filled skies, cool nights and the smell of fresh yams being roasted road-side. It is by far my favorite season in the city. The morning after I landed at Indira Gandhi International airport in November 2018, I sat on the verandah of the guesthouse that was to become home for the next few months trying to fix up meetings with people working within the dating app industry. At the end of my emails and WhatsApp messages to contacts from previous field visits (in 2016 and 2017), I included a short request asking if there was anyone else, they could think of that I should speak to for my research. Within a couple of hours, three separate individuals had responded saying they would be happy to meet, and there was someone I “*must* try and talk to.” That person was Ishaan Sethi the young founder of Delta. Three weeks and a handful of email exchanges later I found myself at Delta’s south Delhi office, sitting in a conference room surrounded walls of clear glass, talking to Ishaan about the origins of the app. Between sips of *chai* he explained that the idea for Delta arose from the frustrations he felt as a self-identified gay single man using dating apps after moving back to India from New York four years ago –

“People had taken my images and made fake profiles. I was getting catfished left, right and center. I would meet people who I had never met in the lanes of Malviya Nagar. I could have been raped and killed, but it did not happen, thank God. And that’s kind of how this got started. I mean apps like Grindr are so sexual. You are telling me there is this dude is four feet in front of me, with a shirtless picture zoomed in...The environment is so sexual that it is pretty much all it caters to.”<sup>9</sup>

The phenomenon described in the quote above – catfishing, risks surrounding public cruising cultures – are not unique to the Indian context. However, the illegality and social stigma that are part of the Indian queer experience only exacerbate the risks of involved in dating online. The norm of explicitly sexual imagery language on gay male dating apps alongside with the risk of violence, moral policing and catfishing, left Ishaan feeling like there was an un-addressed niche in the market for queer folk (both men and women) who wanted to have a safer and less overtly sexual experience dating online, and the idea for Delta was born<sup>10</sup>. The decision to create an app for queer users broadly (as opposed to just gay men), was in part a result of an extended period of market research while the company was being incubated within an established local Indian dating app, TrulyMadly.

Ishaan describes one of his initial conversations with the co-founder of TrulyMadly Sachin Bhatia saying –

“So Sachin kind of spoke to me and said why don’t you lead something like this for me. Cause you are out, you have the skillset I am looking for, product, tech guy, good in business, raised funding, yada, yada, yada. Young, you know... exposed to the US but grew up here. Kind of understands the best of both worlds.”

Skills perceived as positive assets for leading a dating app startup are – knowledge of products and technologies, familiarity with business logics, understanding startup funding structures, youthfulness, and an ability to be intelligible to both a ‘western’ and ‘Indian’ audience. It is this allusion to a cosmopolitan sensibility (“exposed to the US but grew up here. Kind of understands the best of both worlds”) that is particularly notable when juxtaposed with the company’s brand identity of being “homegrown.” Delta explicitly advertises its brand with the tagline “For Indians by Indians” and “homegrown,” variations of this statement are present in its app interface and across public communication materials<sup>11</sup>. However, it appears that when imagining what it takes to be a successful dating app startup, significant value is placed on an app producer’s ability to operate within global flows of information and resources. This does not necessarily take away from Delta’s emphasis on being uniquely Indian, but rather points to the continued importance of being able to operate within a global network of elite actors/institutions to build a successful dating app in India.

## **Mobilizing Queerness**

During the process of market research investigating the feasibility of Delta, Ishaan was guaranteed time, space, and resources by TrulyMadly, this included access to backend technical infrastructure (including servers), mentorship, industry connections, and an office space to work in. The support provided by TrulyMadly was particularly generous considering the lack of overall investment in dating apps in India (following a spike in 2014-2016). Access to these resources meant that the founding vision/conceptualization of Delta was not as circumscribed by funding pressures as the majority of Indian startups waiting on seed support from traditional incubators. The relative freedom allowed Ishaan to take several months to conduct in-depth market research (Ex. focus groups with LGBTQ individuals, working with established queer rights NGOs) on the kind of app that would be successful. As a result of this research, Ishaan decided that shared issues of marginalization and persecution faced by members across the India queer community made a dating app targeting the entire LGBTQ spectrum a viable product. However, mobilizing this expansive imagination queerness within a marketable app meant dealing with several challenges. The week after my initial meeting with Ishaan, I returned to Delta’s office to speak to the technology team working on the app, to try and understand the everyday process of developing the app. The entire ground floor office was in the middle of moving to a brand new space in Gurgaon, a business and technology hub on the outskirts of Delhi (with cheaper rent and more square feet), luckily we found a small empty room down the hallway and squeezed around a small conference table. After a few pleasantries about the state of the move (most were excited since it meant a shorter commute time from their homes) I began



going through the list of questions I had scribbled on my notepad earlier in the day. Among them, was a standard question about “challenges” that came with building a new dating app. In response, a developer succinctly summarized the varied contradictions they grappled with every day, saying –

"We have more genders, and more matching, and everybody has to have the right match, and some people don't know what terms mean so they just click on things. And there have to be more users also, because otherwise there will just be just two people with the same preferences. But we cannot just let everybody in, because we need verification. And there is still a social taboo, because being gay is still a big thing still. So, it's difficult"

His response reveals at least five intersecting issues Delta's team grapple with - technology, pedagogy, scale, safety, and culture. There is the technological/design challenge involving creating an algorithm and navigable app interface that can effectively match people while continuing to provide users with multiple sexual orientations and gender combinations to choose between. Related to this is the pedagogical challenge of educating users about what terms used to signify different gender and sexual orientations mean, while keeping the app UX clean and navigable. For instance, “non-binary” was one of the gender identities provided to users on the app in an effort by the company to be more gender inclusive. However, in focus groups with users Delta found people tended to choose this option without knowing what it meant, and the company was working on including a succinct definition of the term that would help users make an appropriate choice. In addition, there was a problem of scale, where the challenge lay in offering people varied categories alongside which they could orient their sexual desires/identities, while ensuring there were enough people within each category to allow for a person to have a large pool of matches. Compounding issues of scale was the app's emphasis on safety, that meant including a vetting process for each user entering the platform, however this ran the risk of de-incentivizing/limiting the speed with which new users became active members. Finally, the developer noted the underlying social stigma surrounding homosexuality that made users cautious of joining a queer dating app. While the broad types of challenges discussed above are by no means exhaustive, they capture how issues of technology, business design and social context blur together in app production<sup>11</sup>. In the following sections I expand on some of the ways in which these issues play out in Delta's effort to ensure the safety of its users given the particular risks of being queer in India and historical legacies of surveillance through dating platforms.

## **ISSUES OF SECURITY AND SURVEILLANCE**

Over the last fifteen years there have been several cases where individuals (mostly gay men) on online dating platforms have been prosecuted and/or publicly shamed for their activity on these sites. For instance, in 2006, before the era of apps, members of the police force in Lucknow (a large city in northern India) set up fake profiles on the then popular dating website ‘guysformen’ and struck up conversations with genuine members on the site. The masquerading police officers created profiles where they listed themselves as gay and ended up inviting five men to rendezvous at a local city park. When the men they had

solicited turned up – the police immediately arrested them on charges of homosexuality under Section 377 of the Indian penal code.

In a similar story five years later, in 2011, a local TV channel (TV9) in Hyderabad aired a seven-minute segment called “Gay Culture Rampant in Hyderabad.” This television segment consisted of a ‘sting operation’ where TV9 reporters found details of users of Planet Romeo, a dating site for gay men, and publicly outed users by divulging their photos, phone conversations, and chats. Although homosexuality had been temporarily decriminalized by a high court verdict during that time (2009-2012), the sting operation still held massive repercussions by publicly shaming several individuals who were not yet “out” as gay. Talking to funders, developers, and designers working within the dating app space in Delhi and Bangalore about what made queer dating in India different, the most common response was the “taboo nature” of the activity compared to perceived experiences in a vaguely defined ‘west.’ For instance, a UX designer working for multiple dating app startups explained – “It is an accepted thing *there*,” quickly followed by “But *here*, dating is taboo. A Grindr or a Tinder was built to date or hookup from *that* context *there*.” What I believe is particularly interesting here (and the focus of this paper) is not about whether queer experiences truly differ between geographic regions, but rather about how perceptions of intrinsic cultural difference might influence app production. The underlying premise of Delta was based on the perceived discrepancy that uniquely Indian queer needs were being left unaddressed by hypersexualized gay male dating apps and risk of public persecution faced by LGBTQ identifying individuals.

## Verifying authenticity

In my conversations with people working at Delta I was keen to better understand how safety was operationalized over their platform. Ishaan explained the issues faced in the early development stage of the app saying –

“There was a problem of fake profiles, there was an issue regarding people not being able to trust the other person across them. Plus, with 377 in place, people did not want to reveal their identity. People did not want to be talking about it openly. So, it was more about letting people know it was a safe platform. This run by people from within the community. We are not taking your information. This information is just being used to match you better.”

Thus, at Delta, safety depended on ensuring users on the platform were genuine and verified, and establishing the authenticity of users was conceptualized as an integral feature of the app. The essence of the approach to verifying authenticity, I was told, was to “create a self-trusting environment where people were rewarded for creating a more trustworthy profile.” Here, the notion of authenticity was premised on the strength of two characteristics – One, the degree to which information provided on the app suggested that a profile belonged to a real person. Two, that the person who the profile belonged to was “actually queer.” Authenticity received a numeric descriptor through a ‘Trust Score<sup>13</sup>’ assigned to each individual user based on the degree to which they met a series of verification criteria elicited during the sign-up process. Users with higher trust scores were treated as more authentic/verified and therefore received better in-app features such as more credit (called

‘sparks’) and better matching recommendations. In this way, a user’s experience on the platform was based on how genuine they were perceived by the app system.

**Table 2. Breakdown of Delta’s Trust Score**

Verification Criteria	Trust Score Percentage
Facebook account	30
Mobile number	5
Instagram account	10
Email address	5
Selfie (taken in app)	50

*Percentage breakdown taken from information available within the app.*

When a user linked their social media accounts (Ex. Facebook and Instagram) an automated algorithm was used to check the ‘authenticity’ of the profile based on indicators such as the duration for which the social media account has been active (“So if your FB account was created in the last few months it probably is someone who just made for the purpose of being on our app”) and the ratio of friends to length an account has been active (“If you have been around Facebook for like 6 years but have 3 friends on that profile it [the automated algorithm] will say hey something is fishy here”). If a user passed the automated algorithms scrutiny, they received the entirety of the trust score percentage associated with the particular criteria. In other words, an individual could not get a partial trust score for a single criterion. This use of online presence checks as markers of ‘authenticity’ is not new, it is a tactic commonly used across a range of social media platforms and dating apps (Ward 2016). Where things got complicated in the case of Delta was at ‘selfie verification’, a largely manual process where a small moderation team looked through each individual selfie submitted by a user to ensure the image was of a real person, and that the selfie matched other photos on the social media profiles linked with that user. In a cover story of the company by an Indian online LGBTQ magazine (FSOG 2018), the marketing manager of Delta described the unusual quandaries of this moderation process saying –

“Yes, it means I start my day with at least 30 penis pictures, about a dozen cis-men pretending to be trans women just to exist on the app. Yes, that does leave a wrinkle on my nose, but it goes away when I realize that I’ve gone through these profiles, filtered them and every day I make Delta a safer place for the Indian queer community to just be themselves.”

Variations of this experience were echoed in my one-on-one discussions with the handful of people who moderated selfies for Delta, and I quickly learnt that the main issue they faced was of straight men pretending to be ‘queer’ (these men wanted to only meet women on the platform). Overall, there is a high male to female ration across *all* dating apps operating in the country, with industry estimates ranging from seven men for every three women to nine men for every woman (Singh 2018). However, for most other dating apps male overrepresentation does not retract from the fundamental premise of the service. For a queer dating app however the issue of “a bunch of straight men pretending to be bi and hitting on women” as a member of a team put it, was particularly problematic because it diluted the central proposition app of Delta which was to cater to LGBTQ needs. To deal

with this problem, selfie moderators paid attention to profiles of male users that “looked straight.” That is, had no visually defining femme features as well as profiles that listed “interested in women” and/or were flagged as inappropriate by other users. While the team did not directly discriminate against specific users, the indirect profiling of what “queerness should look like” was premised on a structure of surveillance and conformity that seems to be antithetical to the transgressive roots of queerness<sup>14</sup>. In India, there is a long and rich lineage of subaltern cultural formations developing around non-heteronormative sexualities that continue to be claimed as identity groups in the present (Ex. Hijra, Kothi, Arvani, Kinnar). The English word queer was adopted by Indian activists in the 90s to assert the collective marginalization of these subaltern sexual identities and demand institutional and political changes recognizing the rights of these communities, through collective organization (Narain 2004). While shared marginalization provides a powerful unifying force for rights-based initiatives, a separate set of issues emerge when operationalizing the term to provide romantic matches over a dating app. Delta’s efforts to ensure “safety” by verifying users as authentic (as truly members of the LGBTQ community) runs into contradictions operating at two levels. The first is the contradiction of trying to be open, diverse, and non-judgmental about how people might choose to express their sexual orientation yet as a platform having to make narrow judgements about how LGBTQ sexuality should be portrayed. The second is that the idea of queerness as an open, fluid expansive mode of imagining sexual desire/orientation/gender identity is antithetical to the mode of self-disclosure required by users on the platform. This critique of the redemptive possibilities often associated with new digital technologies, is an important one to note because it emphasizes how apps operate systems with larger systems of power. And raises the important question of what kinds of performances of identity and desire are brought under the fold of popular conceptions of queerness.

## MEASURING QUEERNESS, QUEERING MEASURES

“Two cappuccino’s ma’am?” the cashier at a little south Delhi coffee shop chain loudly confirmed over the sound of Ariana Grande’s *Thank U, Next* on the stereo. “Yes, please” I nodded, grabbed the two cups, and began to weave through a sea of MacBook laptops (and their owners) to a table at the corner of the room. As I slid onto my seat, I was struck by how similar the cafe’s aesthetic and clientele were to a hipster coffee shop in Ann Arbor, New York, London, Istanbul or for that matter any cosmopolitan capital in the world. Everyone around me looked under the age of forty, there was a generous smattering of (white) expats, and the sun-kissed walls boasted hanging leafy plants. This young, urban, economically mobile clientele with their disposable income and familiarity with digital trend were the ideal user for dating apps (both heterosexual and homosexual) in the country. For instance, in 2015 TrulyMadly, the India based heterosexual dating app company that incubated Delta, described their ideal users in an early vision board with the words - “independent, evolved, outgoing, liberal, urban, semi urban, progressive, anxious, aspirational, opinionated, influenced”. Sitting across from me, on a mid-century modern style wooden chair was the marketing manager for *Delta*. This was our fourth time meeting in the last two months, and the nervousness that comes with first time interviews had finally begun to morph into a less formal camaraderie.

Today we were meeting to talk about potential ideas for a new video ad campaign *Delta* was hoping to launch in the upcoming months. This was going to be the company's first video campaign and they wanted to get the tone right. The company's founder who I had spoken to several times earlier had suggested we chat, and I was only too happy to get a chance to brainstorm ideas. Working as a PhD researcher using ethnographic methods within an industry space, I often felt indebted to the generosity of professionals employed with dating apps for their time answering my long-winded questions. So, it was always pleasant when conversations became collaborative. Breaking down the state of affairs, the marketing manager began by saying "We are just stuck at the communication bit. So, couple of ideas... So we can't get our finger on it... Should we go with a hard-hitting sort of a video?" They went on to explain that the company was playing around with four different concepts for their first ad. The four versions shared several similarities - they were all short (between two to four minutes), they featured Indians with varied LGBTQ identities interested in finding a romantic connection and each ended with the same tagline about Delta.

What varied between the four video concepts was the degree to which the difficulties of being queer in India was acknowledged. That is, the ads ranged from focusing on the celebratory promise of queer love in India in a post-377 world towards explicitly emphasizing the continued transgressive nature of living life as an individual with LGBTQ desires<sup>15</sup> in the country. More specifically, the role of the dating app in the ad varied from being a tool to express one's queer desire at an individual level (find a partner, meet new people, date), to being a vehicle to mobilize the everyday forms of resistance involved in being queer, at a societal level (building community, recognizing collective difficulties). While the organization suspected that the more positive, celebratory presentation of LGBTQ dating would work better in the light of the general positive sentiment following the repeal of section 377. The marketing manager succinctly critiqued the problems of this portrayal of queer dating saying -

"I am tired of the rosiness. As a queer woman I am tired of it. My friend has known she is a lesbian for 15 years, her parents are really accepting people. She is now nearly thirty, it took half her life for her parents to talk about her girlfriend. Homosexuality has just been decriminalized. Half the people do not know what section 377 is. Half the people do not know... they think you can get married. *Abbi bhi*<sup>16</sup> there is not this awareness and you are giving me this fairy tale of an advertisement. Why? After some time, advertising and storytelling has to address issues that are pertinent to the times. Advertising these days especially when it comes to queer communication has forgotten the important of insight. A good story in advertising is made with insights and ideas. That's my main problem with Indian mainstream queer communication...no insight..."

The disjuncture between the "rosiness" of queer communication and the perceived lack of insight that they note, I suggest is perhaps a consequence of the different ways in which users of these platforms are imagined by investors. For instance, when I asked them the purpose of the ad they explained - It is to get us downloads. That is, it, our investors have told us we need a certain amount of daily active users and monthly active users as results for them to believe we have enough customers. So, this is targeted as getting us downloads for sure." The framing of app success in terms of number of downloads and daily active users is a common metric of defining success, however it is perhaps worth considering the

limitations of such an imagination of the user given particular weight of both the history of criminalization of homosexuality in the country and the moral panics surrounding sexuality in relation to new communication technologies. Managing to keep the balance between making a pertinent political statement and keeping a message palatable for a broad audience is not something new. What is unique here is the rapidly changing politics of queerness in the country that mean that app producers are having to grapple with the framing of how to simultaneously educate, advance and profit from LGBTQ+ dating apps in a fast-growing mobile phone market.

A key issue in marketing a dating app for the LGBTQ+ broadly in India is the inability of metrics of app success (number of downloads, daily active users, monthly active users) to accurately capture the messiness of everyday Indian queer experience, with its specific history of marginalization and criminalization. *Delta's* emphasis on being “homegrown” and catering to the needs of the Indian queer community runs into a roadblock when deeper issues of metrics of success for investors continue to be defined in terms of universalizing measures of “success” and “impact” that do not necessarily take into account the intricacies of regional experience. When commoditizing something that has historically been a rights-based issue (freedom to legally and socially express LGBTQ desires) the standard measurements of app “success” can fail to account for the weight of marginalization and resistance associated with terms like queerx. In the process of converting the messy qualia of queer desire into clean numbers there lies a risk of losing/erasing what makes intimacy human.

## CONCLUSION

While there have been repeated calls by scholars to move towards more “global” theory building, there are still a limited number of empirical accounts attempting to contextualize insights about digitally mediated intimacies in non-western spaces. Both human desires and app infrastructures operate within a tangled web of emotions, cultural histories, technological possibilities, and happenstance. For *Delta*, a company trying to address the romantic/connective needs of different identity groups within the LGBTQ umbrella, highlighting shared experiences across this spectrum becomes integral to maintaining an inclusive brand identity. However, catering to the varied sexual orientations encompassed within this umbrella is often difficult. Situating my research within the specific social, linguistic, cultural, and legal history of India, I observe how *Delta* engages with legacies of surveillance, criminalization, and social dynamics that surround queer experiences in India. *Delta* grapples with the issue of surveillance through fake profiles meant to “out” queer users by attempting to verify the authenticity of members on the platform to ensure safety. However, striking the balance between verifying authenticity while being non-judgmental about how queerness is expressed, is difficult to strike for a platform that prides itself on inclusivity of multiple sexual orientations and holds an expansive vision of forms sexual desires can take. Exploring how the app sign-up process is designed to authenticate its users, I suggest that dating apps run the risk of reinforcing the systems of surveillance through digital communicative platforms that have controlled queer bodies. I emphasize how the anti-identarian, fluid and ephemeral qualities of queerness (as a concept and an umbrella term for marginalized identities) intrinsically resists classificatory systems popular in the

contemporary app industry that tends to prefer clean categorization of what are inherently messy human experiences.

**Vishnupriya Das** is a Ph.D. candidate and Barbour Scholar at University of Michigan's department of Communication Studies. You can reach her [dasv@umich.edu](mailto:dasv@umich.edu)

## NOTES

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1. Neighborhood in central Delhi designed by British architect Sir Edwin Lutyens. Houses several international consulates and Indian government buildings.
2. Both individuals who identified as queer, and straight folk who considered themselves to be queer allies.
3. Emphasis in italics made by author.
4. Both queer (LGBTQ) and heterosexual.
5. Later rebranded as “Her.”
6. The majority of direct evidence present in this paper are variations of statements that have been also been made by the company in public settings/to media organizations. Triangulating claims in interviews against broader statements helped me identify key/important themes. This approach was inspired by Caldwell's (2008) production studies approach to gathering and analyzing material from industry sources by critically assessing each source based on its degree of embeddedness within institutional hierarchies.
7. Field visits to these cities took place in three chunks - Summer 2016, Summer 2017, Winter/Spring 2018-2019.
8. Following the verdict leading Chinese gay male app, BlueD set up a regional headquarter in Noida Delhi. Tinder India launched 23 different gender identity options in the country. Planet Romeo and Grindr began to actively advertise in gay pride events across metropolitan centers. These corporate decisions and technological developments are emblematic of an industry trying to quickly cash-in/adapt to a balance in risk and reward that seemed to have finally tipped in favor of a more open acceptance of LGBTQ sexuality in the public sphere.
9. While a personal story, this is not privileged information. Variations of this origin story have been recounted in public interviews and podcasts for example on the podcast Keeping it Queer (2018).
10. The name of the app alludes to the Greek symbol delta ( $\Delta$ ) that is used to signify difference and change in mathematics.
11. For example - On the company website, Google Playstore description and in interviews by the founder and upper level executives with journalists.

12. One thing that was not mentioned in this discussion, despite being a significant social factor, is caste. In India, caste-based discrimination mediates interactions over dating apps. The ability (and often requirement) to filter users based on their caste and sub-castes has been one of the defining features of online matrimonial platforms in India such as *Bharat Matrimony*, *Shaadi.com*, *Tamil Matrimony* etc. The emphasis caste affiliations in the online matching process of these websites/apps is a continuation of the format followed by matrimonial columns in print newspapers in the country where the format followed in most ads is to begin by identifying one's family by caste and sub-sect (Ramakrishnan 2012). Most dating platforms do not have caste-based identifiers as their primary filtration mechanisms. However, caste continues to exert a force in logics of desirability on these apps because ideas such as skin color, backgrounds, and names act as caste markers.

13. This concept was directly adopted from the structure of Truly Madly, the dating app company that incubated Delta and provided Delta with an initial technical scaffold for their app. For instance, the algorithmic matching process for Delta is built on the Skeleton of Truly Madly's recommendation engine.

14. After nearly a century of being used as a slur, the term 'queer' was reclaimed as a positive overarching identity category as part of community building efforts during the AIDS epidemic of the 1980s. During this time 'queer' grew to signal a growing movement calling for greater inclusivity and social, legal, healthcare rights people identifying as marginalized because of their sexuality. A core component of this movement was a critique of the value monolithic sexual and gender identities (Stein and Plummer 1994).

15. Going into detail about the exact content of these video ad plans is not possible within the paper to respect the privacy of the organization and the marketing plans shared in good faith.

16. Translation from Hindi: "Until now."

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## Following the Invisible Road Rules in the Field Using ANT for CTF

AMITY LATHAM, *Federation University Australia*

JOHN MCDONALD, *Federation University Australia*

KEIR REEVES, *Federation University Australia*

*Australian grain growers look to technologies of farming and cropping systems to maximise their productivity. Zero tillage cropping, variable rate inputs, soil moisture probes, and precision planting are a few practices that farmers may adopt to support their farming practices. To implement cropping technologies, and to achieve the outcomes promoted by the technological innovators, farmers need an alignment of machinery, mobile connectivity, knowledge, skills, farm services support, finance and people on the farm to make it happen. This paper shifts the focus beyond binary and hierarchical notions of humans versus technology and human versus nature, to insider research into the farming practice, alliances, and neighbourly relations to specifically examine how agency makes farmers enact a precision farming technique called controlled traffic farming. Using an actor network approach this paper examines what controlled traffic farming is, and why it makes farmers follow the 'invisible road rules' in the field using an actor network approach.*

### INTRODUCTION

During harvest, as an observer-researcher sitting in the tractor with my camera, notebook and pencil perched on my knees, sharing the confined cabin space with a farm worker, I saw a precision farming system [a system designed to maximise crop yields] from a very different perspective to that of the designers of such technologies. Leo knew he was being watched. I asked him what he was doing every time he touched a new switch, button, screen or control stick. But then I realised that he was not abiding by the rules of a controlled traffic farming system. I didn't say anything. And this was when I had my 'uh-huh' moment and I could see that no matter how prescribed a technological farming system was, there was room for human error and interpretation. Even with a prescriptive and precise cropping system, together with his employer's instructions and his above average hourly pay rate because farm labour was scarce, technology and science fell short of accounting for everything. The farm worker was not abiding by the road rules in the field set down by the system.

This paper is an analysis of farmer agency in the context of a precision cropping system entitled 'controlled traffic farming'. The paper uses ethnography to look beyond what industry expects from this kind of technologically-driven farming practice, and to offer a more nuanced understanding of how agricultural science and technological systems plays out on farms. With experience as a controlled traffic farming project consultant, as well as my thinking as a landholder and grain grower, I position myself as an insider researcher concerned with the roles and rituals of social interaction on the farm and the practices by which farmers maintain their legitimacy. As a place-based ethnography located in the vast farming spaces of Australia, my research also encompasses the hierarchies, positions, and

ways of thinking that comes with geographical location, rurality and the social isolation within the farming landscape. In what follows, we take up each of these dynamics in turn.

This paper aims to draw attention to farmers' relations with non-humans, like machines, technology and farming methods. Relational ties within the network are thoroughly explored. This approach is related to material-semiotics, but at the same time it remains faithful to ethnomethodology in its detailed descriptions of common farming activities, practices, sequences and the habits that makes Australian farming. Actor network theory offers a powerful approach for capturing the ways in which 'agency' is produced via a heterogeneous network of interactions of human and non-human actors such as knowledge, technology, money, farmland, animals, plants, and so forth, and how these interactions depend on both the quality of the actors and the networked context of interactions between actors (Noe and Alroe 2003). This analytical approach demonstrates that agency can be interpreted as a collective property of humans, non-humans and objects and seeks to present the relationships between things that form an assemblage of agents.

As a heterogeneous product, agency generates effects. The sociology of translation located within actor network theory is used to show where these effects are found. This study works with two farmers from commercial farming businesses to demonstrate that farmer agency exists to exercise control within the agri-food structures, but it requires specialized non-human relations and associations to generate such effects. This paper explores these concepts by interrogating farmer agency in the context of machination and technology for crop production. This research is place-specific in the dryland agricultural zone of the Wimmera Southern Mallee region of Victoria, Australia, however it contributes to a global understanding of how agricultural science and technology is adopted and held in place by agency.

#### *What The... CTF*

Controlled traffic farming (CTF) offers insight into how farmers organise their farm practices. Farmers who follow CTF have adopted the concept, by accepting the benefits and making the system fit their farm. This farming system is advocated by a specific group of scientists as well as CTF farm leaders. The Australian Controlled Traffic Farming Association has over 700 members. Some peer-reviewed CTF research includes the whole farm benefits of CTF (Kingwell and Fuchsbichler 2011), soil emissions of nitrous oxide and methane (Tullberg et al 2018), modelling to estimate environmental impacts (Gasso et al 2014), and estimating annual machinery costs for CTF (Bochtis et al 2010). This work aims to contribute to the CTF literature about how CTF science is adopted and held in place by agency constructed as a relational collective. Critical ethnography moves beyond the traditional agronomic perspectives that CTF scientists and farmers offer. This paper can support the innovators and designers of farm machinery and technology by showing that machines, technologies, humans, skills and land are a collective that work together to enact controlled traffic farming.

Controlled traffic farming is a science that enables farmers to potentially be more productive by following the same wheel tracks in fields for every operation. The objective of a CTF system is to minimize soil compaction and achieve all the benefits advocated by CTF scientists such as improved water infiltration, mitigation of randomized machinery passes which cause soil compaction, improved plant performance in non-trafficked zones,

hardened designated wheel tracks for faster field access after rain, and reduced fuel consumption. CTF is a prescription based precision farming system. It relies on global positioning systems (GPS) for real time kinematics (RTK) auto-steering guidance. Axels on the prime mover, whether it be a tractor, combine or a self-propelled sprayer, share the same wheel base width. These are aligned with implements in a ratio to ensure that the machines travel on exactly the same tracks in the paddock for every field operation, indefinitely (see Figure 1). The GPS and the auto-steering software ensure that the implement, like the seeder or the boom-spray, are not overlapping nor underlapping. Machinery accuracy can be as precise as one centimetre.

In an increasingly automated world one may assume that farmers wholly submit and give over to their fully-automated machines and technology for their decision-making. Yet farmers do not give up control. When they apply a controlled traffic farming system they are actively re-shaping a technical system. Soil type, topography, micro-organisms, and knowledge are also part of the system. This work sets out to challenge that farming is more than just a farmer's set of decisions. This work argues that agency is not purely human. Agency is defined as a property of humans and non-humans using an actor network approach to explain how technology and science re-articulate the agential properties of farmers, their machines and the other agents that enter the farming complex.

Controlled traffic farming has been used by grain growers in Australia over the last twenty years. However, not every farmer who grows grain has adopted this system. This article offers two case studies, one farmer who has adopted CTF and another farmer who has not. Empirical evidence is provided to show how agency is distributed as a collective and performed by farmers, machines and other entities. The paper marshals the methodological approach to analyse the social, cultural, material, natural, human and technological elements at play in these case studies. This analysis contributes to a broader understanding of the complex relationship between farmers, technology and their land.



Figure 1. This photograph captures the straight lines and mathematics of CTF ratios. The image shows the wheel tracks and the 12m swath of canola crop remaining to be harvested, parallel to the operating combine harvester. (Photograph taken by the author).

## CASE STUDIES: AGENCY IN THE AUSTRALIAN GRAINS SECTOR

This is a story of two farmers who grow grain. These farmers are neighbours who reside in a small rural farming district in the Wimmera Southern Mallee region of Victoria. This rural district, marked only with a hall and a tennis court, is called Telangatuk East. They are aged in their mid-40's and were once class mates at the local primary and secondary schools prior to their senior schooling years. They are both volunteer members of the district Country Fire Authority and occasionally have a hit of tennis in the local social tennis competition.

Tony, our adopter of controlled traffic farming, went to boarding school in Hamilton, a regional hub in the western district of Victoria, about 100 kilometres south of his farm. He did not complete his final year of high school, leaving early to undertake a farm apprenticeship in the Mallee in the mid-1990's. The Mallee is a region, spanning the north western region of Victoria and South Australia that receives low annual rainfall, and features sandy soils and sparse low vegetation. It was on this 2400 hectare farm where he first experienced continuous dryland cropping. After three years he continued his education with a diploma in agriculture, and then he worked extensively in southern Queensland and the Riverina region of New South Wales laser-levelling greenfield zones for irrigation development. Wayne, our non-adopter, completed his secondary education at the state high school in Horsham, the regional centre of the Wimmera, before he commenced a farm apprenticeship in the western district. Wayne worked on a much smaller, intensive mixed enterprise farm, focussing on sheep production, pastures and high rainfall opportunity cropping.

Both Tony and Wayne returned to Telangatuk East around the same time to farm full-time with their parents, but they needed to supplement their farming income with some off-farm work. Over time Tony has undertaken contract windrowing and harvesting, owned a precision-planter and grader board machinery hire business, and managed a consultancy project for a multi-national Malaysian corporation for the re-development of economic land concessions in Cambodia. Wayne continues to operate a canola windrowing contracting business. Both of these farmers have married. They each have two children; all of whom attend the local community school.

Tony continuously crops 1350 hectares, leasing land from another neighbour and his parents as part of the farm succession plan. Tony has implemented a full controlled traffic farming (CTF) system. Tony has a farm worker called Leo who helps him at sowing and harvest times. Wayne crops 630 hectares and has over 2000 cross-bred sheep on 450 hectares. He owns half of the land, and all of the machinery, with a profit-sharing arrangement with his parents as part of their farm succession. Wayne does not practice CTF as he runs sheep as part of his mixed farming enterprise, but he is interested in the system. The fieldwork in this study examines these neighbours by tracing their actions to understand the agents in their actor networks and how they enrol machinery and technology in their farming practices to find meaning in what they do and do not control.

These farms are located in the water catchment of the Glenelg River; a border dividing political representation in the Federal Parliament and a natural division between high and medium rainfall zones in western Victoria. The landscape is diverse with the Black Range State Park to the east (see Figure 3 for aerial image of the landscape). Remnant paddock vegetation, shallow top soil, creeks, and native pest populations of kangaroos, cockatoos and

emus are dominant landscape features. The mean annual rainfall is 550mm. The vegetation density, the undulation and non-arable zones are symbolic of the traditional grazing enterprises. Tony is the only farmer in the district who does not have stock on his property as a risk management strategy and for income diversification. The district population is 50 people. More broadly, the Wimmera Southern Mallee (WSM) region covers just under 34,000 square kilometres with a total population of 47,000 (WSM Regional Partnerships 2017). The agricultural sector accounts for 25% of jobs in the WSM and 47% of all businesses (WSM Regional Partnership 2017). The region has a projected estimated growth rate for the period of 2016–2031 of -0.6% (Wimmera Southern Mallee Regional Growth Plan 2014). Mobile telephone service and mobile data is limited. This locality is marked as a black spot in the detailed local government boundary map of Horsham Rural City Council (see Figure 2).



Figure 2. Map of the Wimmera Southern Mallee region in Victoria (map sourced according to copyright laws from Regional Development Victoria)

This fieldwork took place over four months leading up to and throughout the harvest period of summer 2018 – 2019. The data for this project includes informal conversations, hand written notes capturing farmers' sequences of action. These notes included what they touched or modified, meaning whether they reacted to a situation or if were proactive in what they did, as well as who they talked to and the topic of conversation. Digital images were taken to support the findings. In total 210 images from three different cameras, a DSLR, iPhone and a drone, to support the research methodology by capturing what took place inside machinery cabins, in the field, and from aerial views. The observations focussed on how the participants operated their harvesting machinery and technologies. To protect their identities, Tony, Leo, Walkers Machinery, Bert and Jake are pseudonyms. The results are succinct stories describing farming practices, decision-making and discussion of how CTF influences human agency. Actor network theory is used to examine agents' associations

and to explain from an insider perspective how agency is distributed as a collective and performed by farmers, machines and other entities.

### *The CTF Farmer*

About twenty years ago Tony commenced implementing a CTF system. Back then he was still farming with his father and his younger brother. Tony saw that compacted soils, which was caused by decades of grazing, hay production and cropping, were limiting their crop production. After a bus tour with a grower group to outback New South Wales to meet a CTF farmer, together with expert knowledge from soil scientists from the University of Queensland who were publishing widely in farm extension magazines, Tony gradually introduced CTF to his family farm business. The process started by moving the tractors' axels out to 3m spaces and matching the width of the seeder to the width of the combine harvester's front. Tony removed fences and some tall paddock trees for easier traffic-ability and to reduce the trees' interference with the GPS signal.

At the same time farmer case studies of the successful implementation of CTF were being regularly published for a farming audience. Tony was reading as much about CTF as he could. While modifying his farm and his farming network, Tony had access to new CTF knowledge, some basic farm soil data, a record of their annual yields, and a membership to a grower group.

In these published journal articles the CTF scientists tended to speak on behalf of the non-human actors who could not speak for themselves, such as residue, soil microorganisms, plant roots, rainfall infiltration and soil air pockets. On the other hand the CTF farmers spoke on behalf of their costs, machinery, a quicker return to the field after rainfall, and their crop's performance. By enrolling a number of agents from the farm services sector who too shared Tony's goals, his fields were transitioned to CTF so that machinery could only drive up and back on the same invisible lines across the fields, indefinitely. Tony, his father and his brother, all witnessed an increase in crop yields; controlled traffic farming was a translation in an actor network sense, by enrolling actors, aligning goals and stabilising the network.

Two decades later, in spring 2018 Tony was faced with a new problem. He could not find a new or second-hand combine harvester front to fit his CTF system. This was a moment when Tony could have forgone the CTF system and returned to randomized traffic widths, choosing a cheaper and readily available 10m front. This would have been easy. Instead, he chose to implement a new CTF ratio. In simple Australian language, he was getting bigger gear. This change meant that he would need a new self-propelled boom-spray as well as a new air seeder for sowing season. Paddock trees would need to be removed. Tony viewed the standing paddock vegetation as an obstacle, nonetheless they were still a contributor to his CTF collective. But the actors in his system were agents because they demonstrated agential capacity to translate the CTF science. CTF is a translation of humans, machinery, nature and technological agency, which as a collective enact the benefits of the science on the farm. Transitioning systems, Tony stabilised his cropping practice by replacing CTF agents with new CTF agents.

For a CTF system to be enacted at harvest the auger on the combine needs to extend over the chaser bin. The chaser bin is a cart that is towed behind a tractor, allowing the combine to harvest and empty its grain simultaneously (see Figure 3). The John Deere



dealership had assured Tony that an auger extension kit on his new combine would be long enough for his 12m system. They installed a kit as part of the contract but it failed to reach the required length. This meant that the chaser-bin could not be filled while both machines remained on the CTF wheel tracks. Tony knew that the auger was too short. He said that another extension kit would have to be installed before the next harvest; it was too late this year.



Figure 3. This photograph captures the harvest where the combine's auger is extended over the chaser bin to unload canola in transit. The farming landscape typifies the dry summers at Telangatuk East. (Photograph taken by the first author).

### *The Farm Worker*

Combine harvesters are designed to auger grain into a chaser bin while harvesting to maximize harvest efficiency (see Figure 3). The tractor tows the chaser bin, which is filled with grain, to empty into a field bin or in a truck. This was the job for Leo, Tony's farm worker. Leo was driving the John Deere tractor. He had GPS and auto-steering technology to drive in straight lines. Leo's task was to follow the same wheel tracks as the combine harvesters once they had harvested the crop.

The chaser bin was limited in its technology, but remained mechanically sound and robust. It had no modern features to support Leo's judgement of how full the bin was. It just had one window, like a port hole, for Leo to see the grain through the bin wall. Leo's decision-making was based on his sight and feedback from the combine drivers, as they had a better view into the field bin than he did (see chaser bin alignment in Figure 4).

Leo was working alongside two large capacity John Deere combine harvesters; Tony's combine and a brand new demonstration model. This combine had 3m axels and a 12m front which meant it fitted Tony's CTF system. It featured the latest technologies and modern driver comforts. As a sales pitch the local dealership brought it to Tony's farm to let him experience this new machine, while harvesting his crop and sharing the synced paddock data between both machines.



Figure 4. This photograph captures the tractor and chaser bin aligned with the field bins. The farm worker is auguring the canola from the chaser bin into the field bin with his judgement of sight for accuracy. (Photograph taken by the first author).

The paddock was heavily timbered with 10 remnant Eucalyptus trees. Two trees had dropped limbs which increased the area of the fixed obstacles. Figure 5 demonstrates the vegetated landscape where the combine harvesters were working.



Figure 5. Two combine harvesters, remnant trees and fallen tree limbs are captured in this photograph and demonstrate the complexity that the chaser bin driver must consider. (Photograph taken by the first author.)

Tony had instructed Leo to remain on the new wheel tracks that the combine left behind in the stubble. Leo drove along the headlands and watched the two combines; from a distance they were hard to differentiate. The chaser bin had to be positioned on the combine driver's left side, on stubble only. Leo followed the combine, staying on the new wheel tracks before disengaging the auto-steer software. He had to steer the tractor straight, avoiding the combine on his right side, but staying close enough to collect the grain. He had to use his judgment of where to drive. He then set the speed on the control stick, and steered the tractor over to the combine and into a safe zone to fill the chaser-bin. Over his right-hand shoulder he watched the auger swing out from the combine and over the bin. The grain crept up the window of the bin. Once filled, Leo moved back onto the wheel

tracks. He re-set the auto-steer to guide the direction of the tractor, and slowed down as he no longer had to keep up with the combine.

Leo wasn't abiding by the CTF system. His hand movements were discrete; he switched software off and on, and he pushed the accelerator forward for speed and pulled it back to slow down. The GPS guidance and auto-steer system were over-ridden. He merged the tractor about one metre towards the combine to collect the grain while in transit. Leo was utilising his own relations with machinery and guidance software by operating the tractor manually. Considering a network approach, the actors were all present yet they were fluid. Leo was re-negotiating the assembled collective through the terms of the short auger, because the machine was not realising the full benefits of CTF. Leo wasn't being negligent, disrespectful to Tony, nor sceptical of the CTF system – if he had remained on the CTF wheel tracks as he had been instructed to do, the grain would have fallen on the ground.

### *The Non-CTF Farmer*

Wayne was a mixed farmer. He did not follow a CTF system even though most of his machinery axels were on 3m widths. He relied on GPS guidance and auto-steering at harvest and sowing. Wayne had participated in a local CTF trials with a grower group a few years ago, and he knew that from this small trial CTF showed yield advantages. But Wayne wasn't convinced that it was worth the effort. Wayne equally liked his sheep. He said that he looked to his neighbour Tony for cropping advice, and to Jake, his best friend and a farmer further along the road, for his stock advice. Wayne had employed a former school friend as his crop consultant.

There was 30 remnant native trees scattered across the 25 hectare field of barley. The barley variety was relatively new to Australia, with end point royalties to Seedforce for the intellectual property rights to sell the grain. However, Wayne wasn't selling this grain; it was allocated as his stock feed.

Wayne negotiated his older model Case IH 2188 combine harvester between most of the tree trunks. He disengaged the auto-steering software to avoid the trees. He didn't always resume the auto-steering after by-passing the trunk; Wayne manually steered the combine towards the upcoming trees rather than re-engaging the software. Wayne had not paid for a subscription to unlock the Trimble software to monitor his crop yield. He disclosed how much the annual subscription to the GPS base station costs. Yet he had no way to map his yields despite his alliance with Trimble technology. The combination of paying for a yield monitoring subscription and the fall-back position that his grain will be fed to sheep, demonstrated a different set of relations in his farming practice.

Wayne's father, Bert was driving the John Deere 8220 tractor towing the chaser-bin (see to Figure 6). This chaser-bin had been modified resulting in an ambiguous form of measurement. To unload, Wayne used his UHF radio to call Bert. Bert drove tractor out from under the shade of a tree and lined up next to the moving combine. Wayne's auger extended over the bin and emptied the grain tank. When this was finished Bert returned to his place in the shade. Wayne was counting how many times Bert took the fully loaded chaser bin down the road to empty the barley into the grain shed. This was Wayne's method of estimating the average crop yield from the field.

For Wayne the total grain loss from the combine wasn't his priority because it shared goals with his mixed farming. The grain that was not collected in the combine could be eaten

by the sheep. The dial in the cabin that measured grain loss never moved, suggesting it was ineffective. Stopping the machine, he got out of the cabin to manually adjust the concaves. He made the threshing clearance smaller to reduce the amount of grain which was un-threshed and spread on the ground. Back in the cabin he said that he “is looking forward to a new header so I don’t have to do this”. Wayne made a comment that he wanted a clean sample for Jake who was coming by later to get a trailer of the grain to feed out. The amount of chaff remaining in the grain sample didn’t seem that important to Wayne. If it wasn’t for Jake he had no reason to adjust the header settings to create a cleaner sample.

Wayne owned his combine harvester. Wayne spoke about his concerns of transitioning to wider equipment and the need to remove some of the standing vegetation in his fields. He mentioned the state legislative requirements to get a permit to cut down native vegetation. He talked on behalf of the trees and the waterways. Nature offered physical obstacles and abstract barriers through law, but for Wayne these were agents in his collective. Wayne did not give up control over nature, rather he actively worked with the landscape and the laws to determine his size of machinery. He wanted to buy a newer second hand New Holland combine in the coming year with modern technologies, but at the same time it also had to align with his Trimble GPS system and his existing MacDon front from his windrower. His wife was not in favour of trading their Case IH; she did not share Wayne’s goals because she was content with the current actors in their network.

Wayne’s relations were hybrid. His agency was an assemblage that generated a collective effect; sheep, sheep feed, lower financial commitments, family, land, machinery, technology, cropping inputs and advice were translated for production. He demonstrated both recreational and business relations with Jake as he sold him barley directly from the header rather to a grain buyer. Wayne’s wife, Janine was camping with Jake’s wife during harvest. Both families bank with the same rural finance company, basing their business on the employee who worked as the regional representative. When this representative was moved to another branch, Wayne was very disappointed. Wayne’s agronomist, Peter, was his old school friend. Wayne terminated his former agronomist to allow Peter to give him crop recommendations, based on trust. Wayne looked to enrol people in his network. Wayne assembled agents in his farming network through brand and human loyalty.



Figure 6. The black top third of the chaser bin shows where it has been extended by the owner. (Photograph taken by the first author)



## **The culture of the Australian grains industry**

Modern farmers continue to change and modify their agricultural techniques to keep up with the terms of trade in the global economy. Wayne is looking to increase his machinery size for work efficiency and Tony has implemented CTF for crop yield benefits. Increases in crop yields, decreases in production costs, management of risk and/or improvement in work efficiency are key ways in which farmers attempt to maintain competitiveness. Higgins (2006) states that the agency of farmers is the subject of ongoing conceptual and analytical debate in the critical studies of agriculture and food. The culture of the Australian grains industry, and the structures of the commodity chain, contextualise why farmers refer to science and technology, such as controlled traffic farming, for profitability and productivity advances.

Australian agriculture is structured to enable farmers to produce near-identical bulk commodities. Farming practices are moderated by others even when connections within this chain seem implausible because farmers are legally required to meet extensive quality standards set by regulators and as a consequence many actors are aligned to safeguard production. Agriculture is governed from Australia's capital city, Canberra. Levies are deducted at grain sales and this is matched with government funding to finance the peak industry body, the Grains Research and Development Corporation (GRDC). Australian farmers participate as individuals in a colloquially-named 'global playing-field'. They are not subsidized; their inputs and grain prices are influenced by the value of the Australian dollar and global supply and demand. Grain grown from using a controlled traffic farming technique is not segregated, penalised, nor rewarded; it remains a bulk commodity subject to standard commodity grades, validating the inquiry into why farmers would make such an effort to enact such a practice.

The commodity chain consists of numerous private enterprises engaged in increasing farm productivity and profitability. They are positioned in the economy by farmers' subscriptions, fee for services, retail costs, research funding from levies and so on. Competition exists within the farm services sector to undertake agronomic field research. Controlled traffic farming research is competitive under this governing structure of the industry. Farmers do not receive any premiums or segregation benefits at the point of sale, however levies may be directed to ongoing CTF research if scientists and grower groups are successful in their competitive application for research in this field.

For Australian farmers, global competitiveness comes by supplying high quality grain compliant with the strict market conditions. Farmers feel coerced and powerless to challenge the political conditions under which they operate, hence they rely on new production techniques.

## **INSIDER RESEARCH ON FARMS USING ANT**

Actor network theory (ANT) is a theory, or rather a family of theories within the field of Sociology of Translation and technosciences proposed by Bruno Latour, Michel Callon (1986), and John Law. This work utilises some of the frameworks from within ANT to examine agents' associations and to explain from an insider perspective how agency is distributed as a collective and performed by farmers, machines and other entities.

Hierarchical social orders are also flattened, working from the ontological premise that humans, non-humans and objects are not separate realms. This is founded on the rejection of epistemology and objectivity, by redefining ontology to allow for multiple ontologies (Latour 1999; Latour 1999b; Latour 2005). This approach shows the role played by science and technology in structuring power relationships (see Latour 1987). It is clear that certain entities control others but by remaining agnostic, the power dynamics between humans and non-humans becomes visible. This means that in a farming environment the insider researcher needs to be aware of the agricultural sciences, natural resource sciences, social sciences, technological and information sciences ready for interpretation at every moment. It is the researcher's role to forgo these ontologies and listen to the participants, or agents, as well as the others that they mobilise, in the study. Giving generalised symmetry to actors implies that the researcher must act impartially and refer to the differing protagonists in the same terms, regardless of their effect upon others. Describing the way in which actors are defined, associated and obliged to remain faithful to their alliances is how we determine performative agency.

Agency is a property of a collective. Agency is about moving beyond human notions of conscious action to an actor network approach where human agency is dissolved among many. As a post-human, practice-based method actor networks shape the idea of agents and the performativity of agency. Each performative definition of what society is about is reinforced, underlined and stabilised, by bringing in new and non-human resources (Latour 1986). The method focused on inanimate entities and their effect on social processes (Cresswell, Worth and Sheikh, 2010). Upon this point the notion of power can change, transferring it to the many resources used to strengthen and hold society still.

An actant is an entity that 'performs' in network relations with other actants (Noe and Alroe 2003). The term actant replaces the term actor since the latter implies only human agency (Higgins 2006). Higgins (2006) defines agency as a property of humans and non-humans through the arrangement of relations, not just those which are social relations. Agency is performative in that it is constituted in and by these relations (Higgins 2006). The ways in which actants perform in an actor-network is framed by the actor-network – meaning that among all the ways in which an artefact, or actant, could be performed such as a zip tie or fence, limits the possibilities that are actualised within the particular actor-network. The notion of 'translation' is characterised as the transformation of objects as they are enrolled into the network and mobilise actants of the network (Noe and Alroe 2003).

Approaching these farms as actor-networks there were many elements that were translated and enrolled into the objective of crop production. There were the farmers, tractors, combines, chaser bins, technologies, mobile phones, satellite signal, land, crop, sheep, remnant vegetation, soil, family, farm labour, grain, market prices, knowledge, skills, values, time, stress and so forth, depending on the heterogeneous strategy of each enterprise. The outcome of the sequence of operations required to undertake the practice of farming resulted in the interactions in the actor-network.

Controlled traffic farming as a translation took the form of a black box. Using the actor network infra-language a black box is the term used to describe an alliance for transforming and translating a diverse range of interests so that an object of controversy is no longer subject to contestation and dispute (Higgins 2006). This is not to suggest that controlled traffic farming is a controversy, rather an actor network analysis identifies black boxes at moments when they open and expose the parts which hold them together. The parts were

exposed when the combine auger did not reach the chaser bin, forcing Leo to over-ride the GPS auto-steering guidance system and manually drive beside the moving combine. Black boxes are a consequence of agential capacity of human and non-humans when the relations between these materials hold and generate an effect. Controlled traffic farming demonstrates the agency between the farmer, and his machines, nature and technology to generate effects on soil and crop yield, which allowed Tony to be competitive as a grain grower in the Australian grains sector.

The relationality of entities is that the entities enrolled get their forms and performances through the relations in which they are located (Law 1999, p 4). This re-interprets our understanding of farm enterprises from an ANT approach. To explain further, if Tony planted Trojan wheat in a field, and the following day Wayne borrowed Tony's John Deere disc air seeder to plant this same variety of wheat on his farm, and theoretically both crops were sown at the same seed and fertilizer rates and received the same rainfall during the growing season; the fields will not average the same. To begin, Tony's wheat is translated into a controlled traffic farming network, where different entities are enrolled to produce the crop. Wayne's crop is translated into a mixed farming enterprise, where sheep as an entity are immobilised in the network and generates a different effect. The same kind of difference can be explored for the other entities enrolled such as farm size, software, grain marketing strategies, rural finance and so forth.

The actants enrolled in the networks on the farm can be actor-networks themselves, e.g. controlled traffic farming, GPS auto-steering technology, prime lamb production, John Deere as a global entity, and local John Deere dealerships, Trimble, and Telangatuk East. The networks also enrolled entities not limited to the physicality of the farms. Actor network approaches bring with them a value of time and a stored energy from historic associations. The CTF scientists, farm succession, Tony's brother's labour, the trip to outback Australia to visit a farm with a grower group which Tony no longer subscribes to, all add to complexity of the heterogeneous network. External entities are enrolled and mobilised as actants into the farming processes: seed, machinery dealerships, John Deere's data storage facility in Brazil, education, work experience, and weather forecasts. The kind of entities and actors that are enrolled or not enrolled into the network and how they are enrolled is characteristic of the enterprise (Noe and Alroe 2003). Comparing Tony and Wayne's education, technical training and cropping work experiences prior to their move home, together with the implementation of CTF and yield monitoring references, and the difference in the number of relations in each network can all be used in 'summing up' that Tony's average crop yields will be different to Wayne's average yields.

The sociology of translation relies on observations and artefacts. Farmers' motives are not really known but they can be inferred by what remains behind. Latour (1999) defines the program of action as a series of goals to undertake operations. Tony and Wayne's goals may have begun by determining the crop types and varieties based on the paddock rotation, market demand and price, balancing nitrogen against the climate outlook, using retained seed, and/or keeping production costs low. Wayne may have considered achieving ample stockfeed for his stocked rate, with surplus grain to sell to Jake.

Social research on farms typically seeks the barriers of adoption suggesting that farmers have limited choice in their actions. Noe and Alroe (2003 p.6) oppose this idea, offering that actor networks are built on choices, but there is no master plan prescribing the mobilisation of the network and there is no platform for making these choices rationally because the

network must establish its own schema of rationality. They interpret this as when you ask a farmer why the farm is organized in the way it is, the researcher will often get the answer that it is because it is the only rational way to do it, because of ... etc. And the argument leads to a place where there was no choice (Noe and Alroe 2003). Only through a reflexive communicative process of the actor-network, the fact of choice becomes visible (Noe and Alroe 2003).

Latour (1986) states that society is not what holds us together, it is what is held together. “Social scientists have mistaken the effect for the cause, the passive for the active, what is glued for glue” (Latour 1986 p.276). The Australian agricultural sector, led by the Agriculture Minister, do not hold farmers, commodities, trade partners and companies together. Practices, as an act of doing, are privileged over ideas. So rather than assuming that structures exist or actions will occur, associations locate knowledge in activities, events, processes and sequences. Power is not something a human may possess nor hoard; either they have it in practice or not, as others have it. Latour (1986) identifies two sources of power. When someone has power – *in potentia* – nothing happens and they are powerless. When they exert power – *in actu* – others are performing the action and not the subject. Power over something or someone is a composition made by many people (Latour 1986 p.265) and for farmers this composition is extended to their machinery and technology. The amount of power exercised varies not according to the power someone has, but to the number of other people who enter into the composition.

Controlled traffic farming consists of a composition of actants. Power over something or someone is a composition made by many (Latour 1986). Controlled traffic farming had power as it made Tony, Leo and the staff from the local John Deere dealership abide by the invisible road rules in the field. Wayne knew that if he wanted to implement a CTF system he would have to remove some trees. As a performative behaviour, it gave Tony identity, and it made the local machinery dealership strive to translate his farm in their own network strategies by demonstrating the new combine in the aim to make a sale. Controlled traffic farming enrolled the GPS guidance, software, farmers, machinery widths, machinery manufacturers and made them follow the system even during a period of transition; there was little room for creativity and self-expression. Only momentary decision making occurred to disengage from guidance to steer around the remnant paddock trees to avoid collision and turn at the end of the paddock during operations.

Like power, agency as a composite produces an effect. Controlled traffic farming is a pre-determined system created by others for farmers to follow through modifications to machines and utilisation of technologies. Agency is what has to be explained by the action of others who enrol. This is evident by the memberships to Australian Controlled Traffic Farming Association, the diversity of CTF research projects, the financial risks to farmers to adopt CTF, the factory standard machinery to fit CTF multiples, and the after-market axel and auger extension kits to keep the system alive. All of these effects support the hypothesis that CTF as a collective assemblage of actants have agency. Agency was a product that was distributed among many.

Agricultural robotics is nearby, removing farmers from their machinery and placing them elsewhere in the network. It's predicted that farm operations will be undertaken by swarm-like micro-machines. This work demonstrates that farmer agency will not be lost when robotics become normal practice. The assumption that farmer agency disappears as technology replaces manual work is not correct. Creativity and freedom in open fields may



decrease, and research and development may be left to the experts, but farmer agency, when we understand this in relational terms as a collective assemblage to generate effects, will always remain.

## CONCLUSION

Controlled traffic farming is a networked assemblage of agents that generates effects. Controlled traffic farming brought with it collective action which held power in a two-fold effect; it supported farmers' grain production and yield advantage, and secondly, it enrolled farm machinery manufacturers to supply objects to fit the system. Yet farmers' power remained on the farm. The grain grown with a CTF system and traded as a bulk commodity was not segregated nor awarded premiums. This brings ethnographers to ask the fundamental question of 'why should farmers bother?'

Farmers' actions are rooted in economics as much as they are ideology. Grain growers increasingly look to technology and science to enhance their productivity. Actor network theory is an insightful tool to show that farmer-agency is reliant upon those far away from their farm, including CTF scientists and the innovators in farm machinery and agricultural technologies. As a practice, controlled traffic farming can be assimilated with any innovative farming technique that brings automation, machination, technology, robotics, humans and land together; where farmers' agency is not purely human but will always be present.

**Amity Latham** is an Australian grain grower. She has consulted both locally and in Asia specialising in farm practice change. She graduated from The University of Melbourne with a BAppSc(NRM), has a Grad. Cert from The University of Sydney and a Master's degree in Sustainable Agriculture from Charles Sturt University. [a.dunstan@federation.edu.au](mailto:a.dunstan@federation.edu.au) or DM @dunstanplant

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## The Change before Behaviour

### Closing the Value-Action Gap Using a Digital Social Companion

GYORGYI GALIK *Design Council & Royal College of Art*

*This paper describes an experiment, designed and developed with the ultimate aim of fostering low-pollution and low-carbon social innovation. It offers an evidence-based practical alternative to conventional, technological approaches and narratives of smart cities aimed at sensing air pollution and mitigating the effects of climate change.*

*In this experiment a new voice user interface is designed, developed and tested with input from participants – to explore the potential of a new, more socially minded adaptation to current AI assistant devices in the home and enhance the field of smart technology design. The experiment is developed with a group of participants to demonstrate how design research can raise novel questions and inform disciplines with an interest in behaviour change, environmental pollution and smart homes. This work demonstrates the potential for technologies to increase the degree of participation in reducing pollution in cities and facilitate the articulation of agency in complex environmental matters.*

*The work has value for designers, ethnographers and researchers working in design for behaviour change and participatory design, as well as practitioners and organisations who are interested in enabling low-pollution lifestyles, developing smart homes and/or emerging AI technologies.*

With more people living in cities than ever before, urban air quality has become a serious concern. Pollution is severely damaging to the health of children. Public awareness and understanding are important, but they're not enough to overcome the structural, infrastructural and social barriers that can impede or limit an individual's ability to transition to a lower pollution and carbon lifestyle (Ockwell *et al.*, 2009, p.309).

Currently citizens are presented with a narrative that gives them little agency to tackle air pollution. They can either change their behaviour to reduce (mitigate) their personal impact on pollution or minimise their exposure to its harmful effects by downloading apps and visualisations.

I question whether current tools that aim to engage people with air pollution account for people's actual needs and behaviours and manage to achieve the desired outcomes in improving air quality and reduce the exposure to air pollution. All too often these interventions simply monitor, visualise and confirm the fact that the air is polluted, while people become increasingly disillusioned by the fact that their air remained just as polluted as ever.

Moving beyond mitigative actions, which won't be enough to address the complexity and severity of air quality and climate change alone, this enquiry is focused on using design research practices to develop an experiment that could shift the focus from pollution monitoring (measuring pollution that has already been produced) to pollution prevention (avoiding pollution before its produced in the first place). To enable preventative behaviours, it introduces an experiment in the home that aims to pre-empt polluting and energy-intensive behaviours before they even happen.

## CONTEXT: DESIGNING FOR BEHAVIOUR CHANGE IN THE HOME

Lockton *et al.* explain (2014c, p.1) energy use is one of the key challenges on which design for behaviour change has focused on. Lockton *et al.* explain (2014c, p.1) that in domestic environments “the majority of work on influencing energy use through behaviour change concentrates on numerical, visual feedback displays for electricity or gas use” (Lockton *et al.*, 2014c, p.2). Brynjarsdóttir *et al.* (2012, p.948) argue that “ambient displays using pervasive sensor technology, ambient computer widgets, social network applications for sharing environmental data, persuasive games and interactive visual displays” are all designed to persuade people to reduce their energy consumption. The authors (*ibid.*, p.952) explain that persuasive technologies tools often focus on behaviours at the individual scale and without considering what role habits play in many people’s everyday behaviours.

Many of the tools the authors analyse also discount the importance of aspects of daily life “that an individual cannot alter” (*ibid.*, p.949). They ignore questions as to “who is actually able to make changes, or how this will change political relationships or social norms” (*ibid.*, p.952). They do not “consider energy in the context of broader socio-cultural practices” (*ibid.*, p.954).

Brynjarsdóttir *et al.* (*ibid.*, p.952) also note that the emphasis on “providing information as a driver for behaviour change rests on a common modernist assumption that people are rational actors seeking to optimise their activities based on what they know” (*ibid.*, p.952). This modernist approach is very similar to what we often see in current visions of the smart home.

### Visual Displays and Smart Home Visions

Hargreaves *et al.* (2018, p.127) question the evidence that smart home technologies actually achieve great energy savings and they note that “there is [even] a risk that they may generate forms of energy intensification”. As the smart home market is forecast to increase substantially, they argue (*ibid.*, p.136) that “it is vital that the energy saving claims are properly scrutinized to ensure [smart home technologies] are not being developed and sold on the basis of unrealistic and potentially misleading claims.”

Strengers (2013, p.25) explains that a core quality of the seamless integration of technology in the home is the achievement of “modernity” and “efficiency”. He notes that this idea of the “homes of tomorrow” (*ibid.*) can be found in the early 1930s’ future visions, in which efficiency was presented alongside “unprecedented levels of luxury, relaxation and indulgence, with excessive energy consumption clearly on display” (*ibid.*).

Robins and Hepworth also (1988, p.157-158) question these visions:

computer home scenarios have a narrow and instrumental fixation on technique – the ‘evolution’ of the household is seen as an expression of some autonomous technological ‘progress’. The dream is a domestic machine-utopia...in which human agents are passive and infantilized. In such technocratic scripts the household is severed from its surrounding (economic, social and political) contexts.

As part of my research looking at an individual’s agency in reducing pollution in cities, I had personal conversations with two energy experts, Dr Sarah Darby (Associate Professor

and Acting Leader, Lower Carbon Futures Team, Energy Programme, University of Oxford) and Geoffrey Stevens (Technology Innovation Manager at the Future Cities Catapult, previously Technology Manager at the Energy Saving Trust).

Both Darby and Stevens described how they had been working on projects aiming to engage consumers in more sustainable energy behaviours in the home, some with more success, some with less impact. The current modes of feedback (e.g. bills, smart meter data, etc.) are not salient enough in their day-to-day activities. By the time consumers get that feedback, they have already forgotten about the associated behaviour.

Stevens believes that “a right advice at the right time”-approach could have a greater impact on energy behaviours. He envisions a solution that provides people with a small reminder of their behaviour at the moment they perform it (such as a message, sound, email, etc.) along with information about the context of that behaviour (for example, ‘reducing your thermostat by 1°C would reduce the carbon emissions produced from heating your home by 10%’).

## Setting Out the Experiment

During our discussions, Stevens introduced me to the UK ‘gridwatch’ and the Carbon Intensity API. As their website states, “the goal of this API service is to allow developers to produce applications that will enable consumers and/or smart devices to optimise their behaviour to minimise CO<sub>2</sub> emissions” (Carbon Intensity API, 2019). For several weeks, Stevens then sent me a message every day in the morning and in the evening during peak hours – reminding me that the grid was overloaded and that I should avoid using the kettle, dishwasher or other electronics.

This experience called to mind my childhood, when my mother would nag me about forgetting to wash my dishes or switch off the lights when I wasn’t in my room. When Stevens stopped messaging me, I noticed that I continued to think about the grid and started avoiding behaviours that would consume power during peak demand. The reminders were still playing in my head, even if he wasn’t messaging me anymore. It made me wonder whether I could design a technology that would provide similar reminders about pro-environmental behaviours.

Moving beyond providing information alone, Lockton (2015) questions “what agency is possible”, and “how to enact change”. In his work (ibid.) in the field of design for behaviour change he explores as to how

“[to develop] design that enables people to understand the wider contexts of their actions, their agency within society, and how they can act to create different outcomes, different futures.”

To test Stevens’ hypothesis, I set out to design a technological experiment that would encourage people to reduce their heating by 1°C as my first project. By designing an intervention that aggregates small, individual change through a networked technology, I believed that I might be able to scale up individuals’ agency and circumvent policy change. I started out with the following question:

(1) Could a connected technology be designed to engender preventative behaviours and afford a more proactive role for citizens in making and/or supporting the decisions that prevent pollution in cities? (bottom-up, individual change); 2) If networked, could a novel

interaction be designed to aggregate the small impact of individuals to achieve a greater collective impact?

I was reminded again to Lockton's work (2015) and how he encourages practitioners to design tools that connect our understanding of how things work and provide "direct ways of enabling action, empowering people to change the behaviour of the systems in which they live" (ibid.). Johnson (2013) also stresses the need to provide people with "practical tools" rather than more information and he also argues that behaviour is driven by context rather than attitude.

## **AI Home Assistants**

Given their growing abilities, AI home assistant devices offered a potentially exciting opportunity to design my pilot experiment. AI assistants are expected to become a bigger part of our daily lives. The number of people using digital assistants is "projected to increase to 1.8 billion by 2021" (Richter, 2016). While keeping in mind that they still have considerable technological limitations, my project was interested in examining if there is an opportunity for: (1) AI technology providers to go beyond current services of convenience and entertainment and provide more socially-sensitive purposes in the future; and (2) designers to explore how these applications – and technologies beyond AI assistants – could be designed to enable behaviour change and engender a more proactive role for citizens in preventing pollution in cities?

I was deeply inspired by the 2016 PhD thesis of Fantini van Ditmar who in "Becoming Your 'SMART' Fridge" took on the role of "a smart fridge software and collecting both quantitative and qualitative data" to question the algorithmic logic behind IoT technologies (Fantini van Ditmar, 2016, pp.124-125). Fantini van Ditmar looked at "how human lives are represented within the quantified approaches of 'smart' technology" (ibid., p.1) and explored "questions of how complex, lived, human experience is oversimplified in the IoT". Her work emphasises the importance of the "observer" and that "smartness is relational". She calls for "a shift in perspective to create more meaningful interactions with devices in the smart home" (ibid.).

The experiment introduced in this paper draws on a larger study and a series of design experiments that were all conducted prior to this paper, in which I aimed to understand how design research can be applied to change energy behaviours and thereby prevent and reduce pollution in cities.

After a series of tests with AI home assistant devices like Alexa and Google Home and with their current technological limitations, as well as a user research experiment in which I acted as an AI myself for weeks, working with a small group of participants, I decided to design my own, custom-built, home assistant device.

## **THE PARTICIPATORY DESIGN OF A DIGITAL SOCIAL COMPANION**

Climate Pal (CP) was designed, developed and tested with two families in the context of home assistant devices to explore their potential in enabling low-carbon and low-pollution lifestyles in the future. Climate Pal is a digital social companion and a system that builds on a voice-based device that is connected to a set of sensors in the home and to open source datasets online to provide feedback to that device.

The development of Climate Pal (CP) started in November 2017. I worked with a two member-team: myself and a creative technologist, Tim Brooke. Creative technology is a field combining design, computing, art and the humanities (Wikipedia, 2019).

Unlike current smart home devices which automate behaviours – such as Nest and Tado, which for example, switch the heating on or off at a given time – CP was designed to remind participants to take action and make decisions about their own energy behaviours.

Kuijer *et al.* (2013, p.6) describe a “crisis of routine” in which the “breaking and shifting of structures takes place” when an “existing practice is reconfigured into novel variations that involve both new and existing elements, and new and existing links” (ibid.). In these situations, when the task to experiment creates crisis of routine, participants are “challenged to explore and stretch the borders of normal practice, thereby creating novel configurations of elements” (ibid., p.7).

Moving beyond mere awareness raising and information sharing, the experiment was built on the ‘ritual’ of Steven’s initial text reminders to me; it tested the hypothesis that if participants are reminded to perform certain behaviours repeatedly, those behaviours might develop into persistent habits that continue even after the device has been removed from the household.

The experiment tested this approach by introducing a ‘storyteller’, a digital social companion that reminded people to proactively shift their current behaviours to new ones. It explored whether participants would change their behaviour to prevent pollution if they were provided with information on “the wider contexts of their own actions and others” (Lockton, 2015; van der Linden), but more importantly, whether the ‘act of reminding’ and giving them the right advice at the right time and at the right location might achieve more successful outcomes in the uptake of certain new behaviours than the provided information itself.

## **Design as a Conversation for Action and for Learning Together**

During my PhD studies in Innovation Design Engineering at the Royal College of Art, I learnt about second-order cybernetics for from my late supervisor, Ranulph Glanville. One of its key aspects is that it frames design as a conversation for action and for learning together. In the words of Dubberly and Pangaro (2015), referring to Humberto Maturana’s work, “design is a conversation about what to conserve and what to change, a conversation about what we value.”

Moving beyond frequent top-down approaches of designing smart technologies, it seemed crucial to undertake a more participatory process in the development of CP that would give people the opportunity to decide what they value, what they prioritise in their daily lives, what activities and behaviours they would be willing to change, and what are the triggers that might help them change those behaviours.

The technology system was so complex that I had to make sure I could be in contact with my participants day to day, if necessary hourly basis for the test to work. Therefore, I decided to recruit people from the postgraduate residence where I used to live at the time of the experiment. The participants were neighbours across the college of 700 Masters and PhD students – living in single, couple and family homes – and recruited through a mass email distributed by the administration office. I received interest from over forty-five families - but due to operational constraints of the equipment, I was only able to roll out the



experiment in two households. I worked with a young American-British couple and a Chilean family of 4 (with the parents and their two young kids).

Looking through the insights from my discussions with energy experts, Professor Sarah Darby and Geoffrey Stevens together, my participants and I decided together the focus of prospective stories relating to 3 domestic behaviours.

**Table 1. Three different actions to reduce energy use in the home**

1.	Reduce heating when it goes above 21°C. Every 1°C of reduction equals 10 % energy / CO2 emissions saved.
2.	Switch off the heating and lights when you leave home.
3.	Shower less than 5 minutes, as heating water is very energy intensive.

For example, when one of the participants started showering in the morning the moisture sensor would peak in the bathroom. If the peak was high for more than 5 minutes, CP would start talking about water scarcity and e.g. how we use so much energy to heat up water for people's homes. It would give context to them why reducing their shower-time would be beneficial to water scarcity in London. When the heating goes above 21°C CP would encourage participants to reduce their heating with 1-degree C and put a jumper on. When they leave the house to work it would wish them a good day and tell them about air quality data and how they could consider walking or cycling instead of taking their car.

With participants' consent, a baseline data was collected to see their behaviours before the intervention. To be able to understand whether the intervention was successful, an impact assessment process was developed. For the first few weeks the system monitored how participants had been performing the behaviours we agreed to observe before the experiment itself started. To create a baseline, each behaviour required setting up a separate set of sensors (detailed in Table 2.). In contrast to the current vendor-led narratives around smart homes – which claim to change energy behaviours by automation and control through the introduction of one device and a few set parameters only – my 'baselining process' became a critique of their current reductionist approach itself. To measure three behaviours alone (detailed in Table 1.), the flats of the two families were filled with an array of sensors.

First, our two-person developer team had to find a sensor-set that had an open API (application program interface) to be able to access the real-time data of the sensors that measured the current and future behaviours of the participants, and also for the interaction and feedback loop to work within the system. Each home had a set of networked sensors. Each behaviour was translated into a set of sensors, had its own 'sensor recipe'.

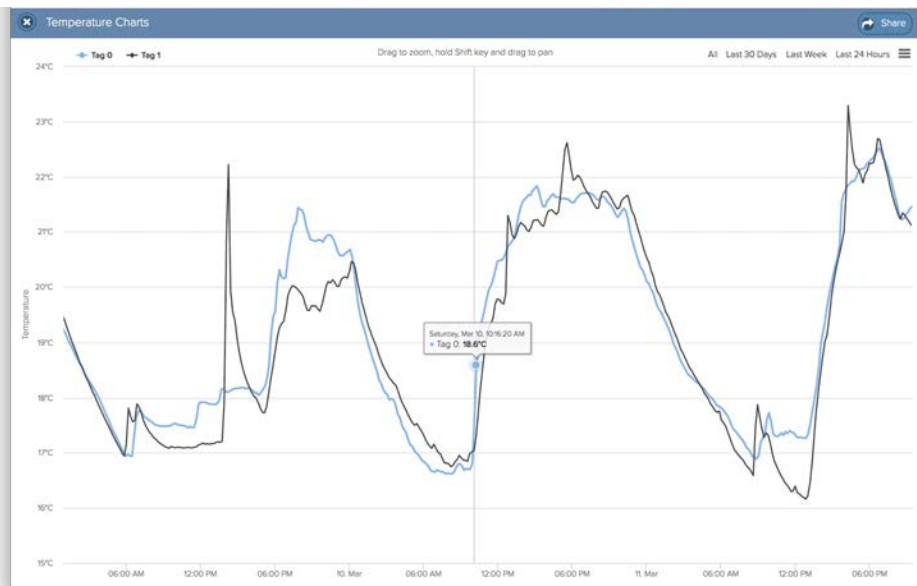


Figure 1. Testing the sensors and observing ambient temperature changes in my own flat.



Figure 2. Ambient temperature sensors throughout the flat – on radiators and placed on the walls on 1.2 meters height, for the most accurate results (product: Wireless Sensor Tags Canada).

**Table 2. The different set of sensors that needed to be provided for a specific behaviour**

1.	2 ambient temperature sensors (Reduce heating when it goes above 21°C.)
2.	1 door sensor (Switch off the heating and lights when you leave home.)
3.	1 humidity sensor (Shower less than 5 minutes, as heating water uses loads of energy.)

The system included a humidity sensor in the bathroom, to measure participants' hot water consumption; and ambient temperature sensors located near radiators and on the walls, to observe how they used the heating in their homes. An additional door sensor was set up to know when they're leaving or entering the house, so when later introduced in the home, CP could say 'goodbye' or 'hello' and remind them to perform specific actions, such as 'Hi there, good morning! What a sunny day! I see you're leaving to work. Do you mind going back and switch off the heating in the living room? It's going full blast. Thank you so much! Have a lovely day and see you tonight!'. (You can listen to one of the messages of CP [here](#)).

Positive examples of social robots encouraged me to continue exploring the potential of AI assistants (Darling, 2016; Fasola and Mataric, 2012; Breazeal, 2011; Kidd, 2008;). In the case of CP, however, there was the added challenge of only having a voice-based interface. As with current AI home assistants, the interaction with CP only embodied human qualities and features through her speech, language and voice.

## **The Device**

For the storyteller device Raspberry Pi was used. It is a small and affordable computer that anyone can use to learn programming. A speaker was attached to the Raspberry Pi – to CP to be able to talk.

For recording the stories, I used Amazon Polly again, a text-to-speech program. The stories generated in Amazon Polly were downloadable and got uploaded to the Raspberry Pis. I sent the participants a sample of recording for each available voice on Amazon, so they were able to choose the one they wanted to work with.



Figure 3. Raspberry Pi and speaker.

The most impactful behaviour change in the home would have been to reduce participants heating. Due to time limitations and unexpected technical challenges, I was unable to do the experiment during the season that heaters are typically used and only managed to develop the connection between the door sensors and the Raspberry Pis. Therefore, I wasn't able to measure the impact of the intervention through the humidity and temperature sensors, even if I had the baseline data of participants' heating and showering habits. Also, measuring participants behaviours through a network of sensors created yet another tension between the framing of sustainability itself and the impact assessment of this intervention. In his critique of the approach of HCI and persuasive technology interventions, Brynjarsdóttir *et al.* (2012) frame human behaviour with respect to metrics that can be quantified, and by doing that, these technologies limit their focus to aspects of sustainability that are clearly measurable (*ibid.*). To somehow address this crucial point of Brynjarsdóttir *et al.* (2012), during this phase of the experiment I decided not to limit the stories to heating and water use only but open up the questions to wider issues of sustainability. Through encouraging small actions that an individual could make, the stories varied from food waste collection, air pollution and sustainable transport, in addition to electricity use and heating in the home setting.

Building on participants' interests in different aspect of sustainability, I started to develop additional stories which addressed these. To understand how to gather and write the right content for the stories, a literature review was conducted. Key learnings from psychological and behavioural science were applied to better understand how to best frame the content for the stories that the device would tell.

While there is much critique of the limits as to what individualist, behaviour models can or can't achieve, I was interested in how current informational approaches could still be

improved. Social psychologist, Van der Linden (2018, p.208) argues that key insights from psychological science should be used to inform behavioural science interventions and that, for example, psychological science has crucial learnings to offer policymakers in managing climate change (Van der Linden *et al.*, 2015).

## **The Right Framing of Narratives**

Looking at research from decision sciences, in the case of climate change for example, Kunreuther & Weber (2012, p.1) explain that it is difficult for people to engage with risks of “low-probability high-consequence events” for which they have limited or no past experience and no emotional engagement (*ibid.*, p.6). Therefore, they suggest that climate change could be framed from a health perspective to enable behaviour change. Their findings suggest that heat waves, droughts and forest fires are threats that people more likely to act upon, especially if they are perceived as endangering their health or life (*ibid.*, p.10).

Whitmarsh (2009, p.418) also suggests that air pollution might be the right point of departure for linking climate change to individuals’ lives and “weaving climate change into discourses of pollution” might achieve a more direct and personal effect. While Moser and Dilling (2007) suggest that negative messages paralyse people, while positive messages and visions surrounding climate change might connect this complex challenge to people’s desires to live a meaningful life.

In their research Bicchieri and Chavez (2010b, pp.161-178) demonstrate, for example, as to how people’s perception of fairness depend on normative expectations and beliefs about what they think they “ought to do” in a given situation; therefore behaviour change can be supported by better understanding what people think about how others behave and how others might think they should behave in similar situations (Bicchieri, 2010a, p.298).

Supporting this argument, Goldstein *et al.* (2008) demonstrate the crucial role of norms in individual behaviour change and explain how behaviours are often dependent on the beliefs people have of what others do and what people think others expect of them. As Van der Linden explains (2018, p.211) descriptive norms can help inform:

- (a) people about the behavior of referent others and (b) set normative expectations about what type of behavior is ‘typical’ and ‘desired’ – reinforcing conformity with the desired norm.

In some cases, norms can also have a reverse effect. In case of energy reduction for example, when in a field experiment participants’ energy consumption was compared to the average use of their neighbours, they adjusted their own use to the norm, even if that meant they started to consume more than they did previously (Van der Linden *et al.*, 2015, p.760).

Global issues such as air pollution and climate change decrease people’s personal efficacy as they don’t believe they can make a difference. Public beliefs about the agency of and need for individuals to change and act are also affected by perceived governmental inaction (Ockwell *et al.*, 2009, p.319). Moreover, people feel that their attempts to respond to such complex issues are useless as other people are not taking action either. They often believe that the responsibility for improving environmental challenges should be a shared responsibility of society, business, industry, and government but they currently perceive that, in reality, “nobody is living up to their side of the bargain” (*ibid.*).

Promoting collective efficacy, the belief that group actions can make a difference will encourage individuals to take action (Van der Linden *et al.*, 2015, p.759), as “if everyone is doing it, it must be a sensible thing to do.”

Social nudges are crucial as people’s perceived self-efficacy – how capable people feel that they can change a specific behaviour (Bandura, 1982) – is often subject to their perception of how many others are participating and taking action (Van der Linden, 2018, p.211). A prototypical behaviour within a group can not only increase further uptake of that specific behaviour, but also enhances the acceptance of related public policies (*ibid.*, p.212).

Perkins & Berkowitz (1986, p.962) emphasise the role of peers in regard to people’s behaviours. They describe how peer influences are affected more by people’s “perceptions of peer behaviours and attitudes” (*ibid.*) rather than by their peer’s actual behaviour and correcting some of these misperceptions might bring about more successful outcomes in enabling behaviour change.

Van der Linden *et al.* (2015, p.759) recommends describing the impacts of climate change through personal and local experiences and engaging narratives (*ibid.*, p.758) that are already happening in people’s immediate regions and communities (*ibid.*, p.760). The authors go on to describe that, as a result of “optimism bias” (*ibid.*), people often believe that these challenges are only happening to others and not to themselves. They also argue that people “less likely to take action when losses paired with uncertainty” (*ibid.*); therefore losses that society endures at this moment in time and focusing on positive and tangible gains from action at present – instead of emphasising negative, future impacts – will both more likely to be successful in engaging people in the long run (*ibid.*). Van der Linden *et al.* (2015, p.761) also argue that people are intrinsically concerned about the environment and the welfare of other people, more than about being motivated by money; therefore policymakers should focus on “intrinsic motivational needs” as those can help them achieve “long-term environmental goals” (*ibid.*).

## **Outcomes and Insights from the Experiment**

Whilst the sample size and the duration of this experiment were limited to make significant claims about long-term behaviour change, this experiment still offered evidence for changing domestic behaviours through the deployment of a connected system in the home setting. The insights my participants shared with me will be valuable for developing the next iteration of CP. One might argue that for a robust evidence the involvement of a larger number of participants would have been necessary; however, the day-to-day (sometimes hourly), ‘neighbourly’ interaction and conversations with the two families were invaluable for the success of this intervention. This was the only way I could iterate and fine-tune the user experience and actually reflect their needs in a more nuanced way.



Figure 4. A sketch depicting one of the test-scenarios when a participant showers longer than 3 minutes

Overall, after the four-week long experiment, the feedback from my participants was overwhelmingly positive. As the dad, Nicholas from the Chilean family described:

In general, we were quite excited about this experiment and having Climate Pal in our home. And every day it was kind of a surprise to hear new stories...although sometimes there were some repetitions, but there was an excitement, an expectation from us to interact with her. Although we had it for only a few weeks, the interaction with it was regular and daily. We had expectations of hearing it and waiting for it to talk when we opened the door. It wasn't only the technological novelty for me, but it felt as if it was taking care of us. And even after a few weeks she became part of our family.

#### *Growing emotional engagement*

Victoria, from the young couple, described enjoying the CP's presence in their households – even without the conversational element. Even if I had been able to provide a conversational AI element in this phase of the technology development, with current technological limitations of AI assistants, the user experience would still not have been satisfying. For those of us who tried to have a meaningful conversation with our home assistant devices this probably doesn't come as a surprise. While the technology has hugely improved in recent years, current AI assistant devices still have a long way to go before being able to conduct a real and enjoyable conversation. However, it still came as a surprise

to me that even with a system like CP, within the first few weeks of the intervention, participants developed strong emotional connection. As Victoria described:

First of all, I just loved when she would talk. So, I would open the door and sometimes I would remember that she might talk, and I would sort of wait and see if she is saying anything and I was always happy when she did.

And as Nicholas noted about their experience living with CP:

We missed it when it was gone. When we opened the door, my kids were waiting for her to talk. But it was not there anymore. Although they still remember the stories, she told us. It felt as if it was looking after us, that it was benefiting us in some way.

This raised further ethical questions that I hadn't fully considered prior to the research. I didn't expect how attached the participants would become to their digital companion and what it would mean to them when the device was removed from their homes. This is something that needs to be carefully considered in future iterations of the experiment.

#### *Learning about and breaking down sustainability into small actions*

Listening to the device's stories every morning when they left the house both families said they learned about a variety of issues, some which they hadn't considered before, such as water scarcity, meat consumption, or food waste collection.

I think of us as a family with fairly sustainable lifestyles. We always walk everywhere for example. But it made me consider more on how we use single use plastic for example and waste management in the UK. Our little friend, I mean CP made us aware of this issue more.

And in the case of Victoria:

I thought that the thoughts she had about remembering things...the content itself was really cute and helpful.

#### *Co-designing the stories*

In collaboration with the participants, I iterated the length and timing of the different audio files during the experiment to ensure the device didn't become too annoying. I also encouraged the participants to write some of their own trigger narratives and reminders that was then uploaded to their device. From their feedback during the process, I learned that the stories needed to be shorter, so they could listen to them fully. Long stories were too hard for participants to focus on, especially during the morning rush. As Victoria described:

Two things I noticed...one time we opened the door and we ended up not leaving and so we shut the door again...and I think that knocked her off, so when we were coming home, she would go off, because she thought we were leaving. The other thing was...once I was in such a hurry that I shut the door on her as I was leaving, and I heard her talking to me while I was walking down the hallway. That was the only time I missed her. But these things didn't bother me. I didn't think she was annoying, or she talked too much. The sound and her voice were fine as well. I



really enjoyed having her and I would definitely have something like this in my house.

After testing a few iterations and changing the rules of the system to address my participants' feedback, we settled on the right length of and their interest areas for the stories. As Nicholas explained:

In the beginning some messages were a bit too long when we were in a rush in the morning, but that was an improvement when they got shorter. We also wanted to listen to some of the messages earlier in the morning, not when you open the door only, so we could choose the right outfit, for example, when we needed to change to a different commute.

#### *Infrastructural barriers to change*

While the motivation to perform the new behaviours were there with both families, some of the behaviours such as collecting food waste the participants didn't have the opportunity or the necessary infrastructure in place to perform the uptake of the new behaviour. As Nicholas explained about his experience:

The challenge was that she told us all these facts, but then when I wanted to start food waste gathering for example, I realised there is no system set for me to properly do that. That was a challenge! Someone needs to provide these services for us, so we can actually do them. Some other actions she recommended it was easy to follow and was in our power to do.

This result supports the same argument of those before me (Lockton *et al.*, 2014a, 2014b, 2014c, 2015; Marteau *et al.*, 2014; Brynjarsdóttir *et al.*, 2012; Shove, 2009; Ockwell *et al.*, 2009;) that without the necessary institutional, structural and infrastructural changes in place individuals will not be able to alter some of their behaviours to reduce air pollution and mitigate the effects of climate change.

In the case of Victoria, CP made her especially conscious about her consumption of disposable plastics, such as carrier bags and water bottles.

This is something I thought a lot more since we had her. Because this subject was so salient...as she would talk every time when I was about to leave home, it gave me an idea on how I could improve my own consumption and reduce my own plastic use. Which was great. In general, I really loved having it. It was also just nice to have that reminder before you run out of the house for the day. So that was great.

Interestingly, this effect wasn't always directly related to the content of the stories. It was surprising to see the connections she made between the different stories and how those made her think about her daily activities, sometimes completely indirect ways. For example, on a morning when CP told her about the impact of cattle on greenhouse gases emissions – she remembered to bring her reusable water bottle to school, to avoid buying a disposable one. She said she remembered to do this not because of the message about cattle, but

because hearing CP's voice reminded her of a previous day's message informing her about the harm of disposable plastics.

#### *Unexpected outcomes*

There were also five quite unexpected outcomes with both families: first, listening to the interviews afterwards, both families remembered advice that CP gave them that wasn't actually included in its programme of stories. It seemed as if the device started to encourage them to sustainable behaviours outside of the scope of the experiment.



Figure 5. A sketch capturing a dinner discussion between Nicholas and his in-laws visiting from Chile. During the family dinner someone came home and opened the door, which triggered CP to tell a story. This interrupted their whole dinner conversation. CP happened to giving them advice on shifting towards a plant-based diet and encouraging participants to eat less meat.

Second, during this design research experiment, technical glitches became a source of novelty and led me to key insights that I hadn't even thought of. As Glanville (2009) argues while explaining the exciting similarities and differences between *design* and *conversation*:

in most models of communication, the concern is to reduce error, in design the so-called "error" may be a source of novelty. What is often thought of as error is welcomed as a means of enhancing creativity. This novelty comes from everything in the system working together.

Third, after listening to stories, both families described how they had conversations about the facts and actions. In the case of Nicolas, his in-laws were visiting them from Chile,

and they became part of the experiment. Having listened to the stories together, they then discussed them as a family during dinner time.

Victoria and Ben described having their friends over for drinks or dinner and how they would also discuss and debate the topics and stories that CP shared with them:

My friends thought it was really interesting. When people were in the living room and she would talk. People were startling at first, but then everyone would be quiet and listened to everything she said. Which was nice because it caused a little bit of a 'pause' I guess.

The 'pause', as she described it, reminded me to the research of Kuijter *et al.* (2013, p.6), which argues that achieving a positive reconfiguration of an existing social practice, the "crises of routine could be deliberately staged". They introduce the idea of "trigger products that can form leverage points or triggers for playing out more radically different configurations" (*ibid.*, p.7).

Fourth, in a follow-up interview, Nicolas also described how his son started reminding him about things that CP had told them about, but that he had already forgotten. For example, his son asked him to carry grocery bags with them to the supermarket and travel to school by bicycle or scooter, even on the days when the air quality was good.

Unexpectedly, the experiment evolved into design for family behaviour change. During our conversations Nicolas also described how CP's reminders to observe and proactively participate in these small, daily exercises made him feel they were building a more positive future together for the long-term. The device enabled collective, cross-generational action at a family-scale and had a greater collective impact than if it had focused on an individual:

My son reminded me during the day what she had said the morning before. My son has a better memory for these things than I do...I am scared of what will happen with my children in the future with climate change and pollution. This device tried to help us improving our quality of life, making things better every day to have a better future for my children.

This outcome brought me back to Van der Linden's research (2018, p.211) that it is key to inform people about the behaviour of important others and raise normative expectations about what type of behaviour is "typical and desired". The more people follow a desired norm, the stronger the "social signal becomes" – persuading others to further comply. In other words, the more people hear their friends, family and social circles talking about environmental issues, the more these issues will be viewed as risks that require further action. This does not only increase their perception of risk but their "intention to act" (Van der Linden *et al.*, 2015, p.759).



Figure 6. Participants started reminding each other to the stories and advice that CP shared with them.

The fifth and perhaps most delightful outcome with both families was that after CP was removed from their homes, they kept hearing her voice and advice as they were walking out the front door in the morning. Both families reported that this even prompted them to change their behaviour, going back in the flat to grab a reusable grocery bag or switch off the lights.

Lastly, both families described how they had a greater sense of trust for CP than they would have for a device like Google Home or Amazon Alexa. They explained that this was because they understood how the device worked, they owned their data and knew that data wasn't being used for commercial purposes. As Nicholas described:

I would have felt uncomfortable having an Alexa in my home. It is so corporate and always wants something from you and Amazon profiting from it. But I trusted this device as I knew how it worked. I saw what happens with my data. I owned the data. This could be a good device to create a system...like a Wiki voice user interface, like OpenStreetMap. You can build your own conversational device, owning your own data. Customise stories that you're interested in. Everyone becomes the maker of their own device and experience.

Victoria also mentioned a very similar feeling:

I liked the fact that she wasn't listening to us, but that she knew when I was leaving the flat and coming home. Thanks for asking us to participate.

## Next Steps – Improving User Experience

Our two-person development team faced a variety of technological issues during the development of this design experiment.

Both families expressed a desire to have follow-up conversations with their CPs. With further development, I am hopeful that home assistants will become better conversationalists and this challenge could be addressed. Listening to the stories made piqued their interest in the different topics and made them curious to learn more. As Nicholas commented:

We wanted to hear more interesting facts...even more facts, so it doesn't become boring. When she wished us a nice day, it was kind of nice to have her. Although it would have been great if we could interact with her and wish her a nice day in return. We liked the behaviour specific advice as well...It would be nice to find a way, so that we could interact and talk to the device. A two-way conversation...obviously I understand the limitation of the current technology.

Participants also requested that in further developments of CP would give them more feedback about how their behaviour was changing in the household. With positive encouragement, they believed they would be more motivated to maintain their new behaviours.

One participant also said he would have preferred to listen to the stories while having breakfast or washing his teeth, rather than at the moment when he was leaving the house. This was especially true for advice that required forward planning. For example, when the advice was about changing his mode of commuting in the morning. If he was going to change his commute to work, he would need to know that in advance, so he could leave the house earlier. This made me realise that I don't only need to develop the right content at the right location, but also at the right time. If a participant wants to shift a behaviour, for example their commute in the morning, consequently they also need to change every behaviour prior to that specific behaviour, for example, choosing a different outfit, getting up earlier. So, a series of behaviour changes need to happen before that one behaviour can be changed. The experiment suggests that a trigger device can indeed support these changes by disrupt or intervene with the right advice, at the right time and at the right place.

This 'right advice at the right time and right place' approach reminds me to the "missing feedback" as Donella Meadows (1999) describes it in her 6<sup>th</sup> leverage point. As she states (*ibid.*, p.13) "[missing feedback] is not a parameter adjustment, not a strengthening or weakening of an existing loop. It's a new loop, delivering feedback to a place where it wasn't going before." It is "one of the most common causes of system malfunction" and she argues that "adding or restoring information can be a powerful intervention" (*ibid.*). However, she also emphasises that it's important that the missing feedback be restored to the right place and in compelling form referring to the example that "it's not enough to inform all the users of an aquifer that the groundwater level is dropping as that could initiate a race to the bottom" (*ibid.*).



Figure 7. A sketch depicting how CP is connected to open datasets on the Internet to provide real-time information on different environmental matters including air pollution, traffic congestion, weather.

With further development, CP can become a reliable platform for triggering particular sound files in response to different behaviours in real-time. There are a number of possible avenues to explore, including linking stories and activities to the real-time load on the electricity grid (particularly where this may lead to different pricing per unit – supporting governmental aims with demand-side response strategies), applications in local or community microgrids where generation as well as consumption (and the balance between them) comes into consideration.

In the future CP (in an advanced form) could be networked to other devices, to form a community of participants. This would make it possible to conduct practical tests with social norms and peer-to-peer effect, while providing participants with an aggregated measure of their collective impact. To achieve an aggregated change through a network of CPs remains the question and opportunity for the future.

While I wasn't able to make CP into the network of devices I had originally intended (to enable collective action at a wider scale). Nicholas and I had long conversations about how CP and similar devices could be used in the future:

I also thought it would be good to connect it many different data sources. It could be an interesting challenge to build this as a network and allow the government or the city to talk to its people. Tell us what the goal is for today! I think it would be quite powerful to know the weekly or daily goal of the government that has been set for the day...for millions of people in the city. And receive some feedback that those people who tried to act collaboratively, we achieved this or that much of an impact and improved our quality of life together. And then when you get home at

the end of the day you can listen to the feedback from the government and what you achieved as a collective. I am not an expert, but air pollution is really bad. We could set certain targets that we could achieve...if air pollution were so bad for 4 days this week that let's do something about it.

## **FINAL THOUGHTS – DESIGNING FOR THE CHANGE BEFORE BEHAVIOUR**

This paper explored how new technologies may facilitate articulations of citizen participation (Gabrys, 2018, p.508) as a means to afford increased agency in reducing pollution in cities through design for behaviour change. The design experiment focused on stimulating voluntary social change through the participatory design of a purpose-built, connected home assistant device that supported participants' transition to low-carbon and low-pollution lifestyles with a set of stories that were triggered by specific household behaviours.

With similar aims to this enquiry, Lockton *et al.* (2014a; 2014c) explored the sonification of energy data in households, as a means to make energy more 'visible/audible' and encourage householders to consider their energy consumption in near real-time.

Building on Lockton's thinking around energy displays, and visual and audible feedback and also moving beyond sensory feedback of near real-time energy use in the home, I set out to shift the focus to designing a technology enabler that helps pre-empt polluting and energy-intensive behaviours before they even happen.

As a result of the experiment, a new argument has started to emerge. Design for behaviour change – the field I aim to make a significant contribution towards – may focus on the wrong side of a behaviour. Instead of designing for the behaviour to change, I was interested in designing for the change before the behaviour is even performed. If a person participant wants to shift a behaviour with the help of a digital social companion (e.g. their commute in the morning, their choice of food), they also need to be supported in all the changes that lead and allow to that behaviour to be shifted by giving them the right advice, at the right time and at the right place.

### **Designing Technologies that Create a Collective Experience and a Shared Purpose**

The final experiment evolved into design for family behaviour change. This was an unexpected outcome, resulting from the fact that the device was a voice user interface and so the advice/stories were audible by all participants across the home. During our conversations participants described how the home assistant device reminded them to observe and proactively participate in small, daily actions and also how, as a result of this, they started to remind each other to those actions – even when the device was not around. Participants described that the device made them feel they were building a more positive future together with their families through this shared experience. The participating families had a greater collective impact than they would have had individually. Unexpectedly, the experiment also affected people beyond the immediate circle of the participants, through learnings and discussions they took away after visiting the participants' homes.

## Transmitting Social Incentives

The evidence established through this enquiry suggests that technologies that are deliberately designed to involve more than one person from the direct social circle of an individual (e.g. family members, colleagues, peers, classmates) as part of the interaction – with considerations to the family and/or peer dynamics of an individual – might have a more successful outcome in enabling behaviour change. Practitioners working in the field of design for behaviour change might benefit from experimenting with technologies that allow more people to simultaneously participate and interact with a technology enabler.

Design for behaviour change might benefit from considering designing technologies that would inherently inform people about the behaviour of important others and raise normative expectations about what type of behaviour is “typical and desired” (van der Linden explains, 2018, p.211). They could support socially minded nudges in leveraging and transmitting social incentives that regulate individual and group behaviour” (Van der Linden, 2018, p.207; p.209; Bicchieri and Chavez, 2010b, pp.161-178; ), and refine the beliefs and perceptions of people have of what others do and what people think others expect of them to do (Goldstein *et al.* 2008). In other words, if the individual is encouraged by the shared experience and actions of their immediate peers, family and friend circles it might increase the chance of a successful transition to a new habit.

## Trigger Devices/Technology Enablers

When the device was removed from participants’ homes, they kept hearing its advice as they were walking out the front door in the morning. Both families in the experiments reported that having lived with the device had even prompted them to change their behaviour, for example going back in the flat to grab a reusable grocery bag or switch off the lights. This insight reminds me to the Kuijer *et al.* (2013, p.5) argument that “through performance, the body becomes trained in a certain way, when knowledge about the practice becomes embodied in the practitioner”. The authors note that (*ibid.*, p.6):

instances of adaptation, improvisation and experimentation in performance can be triggered by all kinds of smaller and larger changes in circumstances, such as for example the introduction of unfamiliar elements

## Designing for a Deliberate ‘Pause’

The evidence established through this experiment also suggests that it is indeed possible to design technological triggers for the space before behaviour and make people consider their actions before they actually act. In other words, it is possible to design a technology enabler that intervenes in the gap between value and action – between people’s beliefs, attitudes and actual behaviour – and gains time for a ‘pause’ between participants’ ‘auto-pilot’ behaviours and more effortful considerations of their day-to-day activities to shift their old behaviours to new ones.



## Closing Remarks

I argue that with future technological advancements AI home assistant devices could become a way to encourage people to articulate their agency in environmental matters and collectively achieve a greater impact and reduce pollution in cities.

In contrast to mitigation-focused, reductionist, technological approaches and narratives of behaviour change, this paper aimed to advance the current thinking around smart technologies that address energy use and pollution in cities so that those working in this space consider both the messiness and complexity of behaviour change and of air pollution and climate change.

Over the last fifteen years in my day-to-day work I have been facilitating conversations between communities, city leaders, government officials and technology companies to support them in better understanding each other and to enable meaningful collaboration, and also to better understand how to enable both individuals and systems to change. I believe that it is crucial to ensure that all voices can be equally expressed, heard and represented in complex environmental and political processes, to create places that are more just and liveable. The design experiment, Climate Pal (CP) was a manifestation of this goal. Inquiry into my participants' everyday lives introduced opportunities to discuss how things could be otherwise. Through design research, I hope I managed to challenge assumptions that have long been dominant in smart technology design and offered new ways to design technologies that could reduce pollution in cities.

**Gyorgyi Galik** is a London-based innovation designer, design researcher and environmental advocate. She recently passed her PhD viva in Innovation Design Engineering, School of Design at the Royal College of Art in London. Alongside my studies, she is working as a Lead Advisor of Design Council's Cities Programme.

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## Case Studies Session

# Agency in/through Partnerships

Facilitator: Patricia Sunderland (CRAstudio.com)

The cases documented in this section offer us powerful, unique, and comparative demonstrations of ways in which partnership lies at the heart of successful ethnographic and design interventions. Crucially, the cases simultaneously demonstrate the way that perceived agency – on the part of all involved in these partnerships – lies at the heart of the proximal success of our endeavors as well as the ultimate impact of these efforts on the overall business enterprise and future possibilities.

Including and moving beyond the user-researcher-stakeholder partnership, the cases make us ponder the fact that our research should also take into account pre-existing partnerships in the lives of those we research, for instance, to consider family relationships (and tensions) as well as relations among players and departments within an organization. Importantly, these cases also make clear that successful solutions and strategies must incorporate participant emotions. In fact, the authors push us to realize that emotion is ultimately an agent and point of view we must take into account in human interaction, whether that interaction involves other humans or digital and AI technologies.

Finally, these cases provide powerful examples of ultimate project success as incorporation of ethnographic and design research methods and mindsets as partner across the organization and within future endeavors. As two of these cases make clear, ethnographic video is an ideal partner for researchers to use in this spread of our own individual and collective agency across time and space.

## Increasing Perceived Agency in Human-AI Interactions

### Learnings from Piloting a Voice User Interface with Drivers on Uber

JAKE SILVA, *Uber Technologies*

*This case study seeks to increase understanding of how agency is fostered in human-AI interaction by providing insight from Uber's development of a conversational voice-user-interface (VUI) for its driver application. Additionally, it provides user researchers with insight on how to identify agency's importance early in the product development process and communicate it effectively to product stakeholders. First, the case reviews the literature to provide a firm theoretical basis of agency. It then describes the implementation of a novel in-car Wizard-Of-Oz study and its usefulness in identifying agency as a critical mediator of driver interaction with the VUI before software-development. Afterward, three factors which impacted driver agency and product usage are discussed -- conversational agency, use of the VUI in social contexts and perception of the VUI persona. Finally, the case describes strategies used to convince the engineering and product teams to prioritize features to increase agency. As a result, the findings led to substantive changes to the VUI to increase agency and enhance the user experience.*

## INTRODUCTION

Founded in 2009, Uber is an on-demand transportation platform that connects riders to available drivers through a mobile app. Today, Uber is available in more than 700 cities globally and is expanding its platform services to include food ordering and delivery, e-bikes and scooters and freight logistics. To help fulfill its goal of making transportation safe and easy for everyone, Uber is developing a conversational voice-user-interface (VUI) for its driver application to enable hands-free interactions with it. User research played a critical role in shaping the VUI's design throughout the product lifecycle. First, an exploratory in-car Wizard-of-Oz (WoZ) study was conducted prior to software development to identify what functionality drivers wanted in a full-fledged conversational VUI and to observe how they interacted with it while driving. Later, three studies in the US, India and Australia were run in which drivers used a minimal-viable product (MVP) VUI for two weeks on actual Uber trips and gave feedback on the experience through SMS messages, a survey and semi-structured interviews. Insights from the exploratory WoZ led to the identification of agency as a critical mediator of driver interaction with the VUI and a factor that could impact product usage if not supported. Subsequent real-world insights from the studies in the US, India and Australia confirmed agency's impact on the VUI user experience and usage.

The emergence of AI technology like VUIs raises important questions on how the relationship between humans and technology will change moving forward. While some technologists insist that AI will soon automating everything, it is more likely to augment human capabilities for the foreseeable future rather than replace them, creating a new paradigm of greater human-AI collaboration (Simon 2019; Sloane 2019; Manyika 2019). Consequently, agency and its role in mediating human-AI interaction will require reconfiguration. If not, designers and developers risk the disuse of their technology due to

reduced human agency. Thus, this case study seeks to increase understanding of AI's impact on agency by providing insights from the development of the Uber conversational VUI. First, the case reviews the literature to provide a firm theoretical basis of agency. It then describes the implementation of the in-car WoZ and its usefulness in identifying agency as a critical interaction mediator prior to software development. Afterward, three factors which impacted agency and product usage are discussed—conversational agency, use of the VUI in social contexts and perception of the VUI persona. Finally, the case describes how the researcher overcame challenges in convincing the engineering and product team to prioritize features to increase agency.

## **AGENCY IN HUMAN-AI INTERACTION**

### **Defining Agency**

Agency—defined as the feeling of control over one's actions and their consequences - is a fundamental human trait that significantly influences how humans behave and interact with one another and technology. Consider for example the seeming irrationality of adding placebo buttons to crosswalks and elevators or those who fear flying but drive every day despite the latter being a statistically much riskier endeavor—agency undeniably has a profound effect on how humans behave. And while agency is commonly considered an individual phenomenon, social cognitive theory provides a more nuanced framework which acknowledges the impact of social factors beyond the individual on agency. Specifically, the theory defines three types of agency—individual, proxy and collective (Bandura 2000). On an individual level, agency is exercised through the sensorimotor system which associates actions one takes in the environment to their causal effects. For example, think about a person opening a door—they feel the force of the rotating handle and visually see the door open. On the road, a driver moving through a curve feels the centrifugal force on their body reinforcing the outcomes of their actions. But agency is not strictly a physical phenomenon. It's also influenced by one's context information, background beliefs and social norms - a concept known as judgement of agency (Synofzik 2013). In other words, people not only experience agency physiologically but also interpret it subjectively, making it an imprecise measure of reality in which a person may feel more in control than they actually are. Beyond individual control, people exercise proxy agency by influencing key social actors in their lives, like colleagues, employers and government, who have the resources, knowledge and means to help secure desired goals. Finally, the need to form groups to achieve objectives unattainable individually means people also exercise collective agency whereby groups develop shared beliefs on their capabilities beyond the individual.

### **Agency and Human Interaction with Technology**

Agency is fundamental to people's successful use of technology through user interfaces and belief that it serves them in achieving their goals. This is especially true in the digital world where processors, logic and complex algorithms increasingly play an intermediary role between user input and their resulting actions. Take for example sending an email to a friend. While seemingly simple, pressing send triggers an intricate orchestration of largely invisible events to get the message to the receiver. Schniederman highlights the need to

support agency in this digital space in one of his ‘Eight Golden Rules of Interface Design’ saying digital products should allow users to be the initiators of actions and give them the sense that they are in full control of events (Shneiderman 2016). Familiar interface elements like hover and focus button states, mobile-phone haptics and loading GIFs as well as the point-and-click/tap paradigm of today’s digital interfaces all serve to give users this sense of control.

And while people enjoy a high degree of control in the majority of today’s digital interactions, the increasing intelligence and pervasiveness of AI technology requires a rethinking of how human agency will evolve and be fostered in human-AI interaction. But before going further, it’s useful to discuss the current evolution of traditional automation into what many term AI. In the classic sense, automation is the use of an artificial mechanism like a machine or software to partially or completely replace the human labor needed to accomplish a task. Accordingly, everything from the appliances that free us from washing dishes and clothes by hand to the autopilots that fly airplanes can be considered automation. And while deterministic tasks like these have been automated for decades, technology has reached a transition point where it’s able to perform more complex and non-deterministic tasks. Consider call centers for example. Where phone representatives once used judgement and skill to interact with customers, AI software can now coach them in real-time giving advice on speaking pace and rapport with the customer (Garza 2019). This insertion of AI to augment human capability raises serious concerns on how representative agency might be reduced necessitating management to frame it as an improvement tool rather than a replacement one.

The above example highlights the need for designers to invent new ways to foster agency-sharing so humans and AI can achieve shared goals effectively. Examples of such strategies already exist in some familiar AI-powered technology. For example, search engine autocomplete gives users automatic, yet easily dismissible suggestions that accelerate search and refine ambiguous human intents creating a mutually beneficial shared agency (Heer 2019). Proposals to augment agency in more complex interactions include making the logic behind AI decisions interpretable to users (Holstein 2018), designing shared representations of the human-AI mental model (Heer 2019) and even allowing users to self-assemble an AI system itself (Sun 2016). The risk of not supporting a user’s agency is them disusing or misusing technology - an all-too-common outcome in conventional automation. For example, reduced agency from cockpit automation can decrease a pilot’s situational awareness (Endsley 1995) and even degrade their fine-motor flying skills (Haslbeck 2016), contributing to aviation accidents. Research on collaborative human-AI systems finds similar risks with participants in one study facing significant difficulty in building agency during joint actions with an artificial partner which hindered successful task completion (Sahaï 2017). Diminished agency can also harm emotionally. A 2017 ethnographic study of unmanned drone pilots found for example that reduced agency diminished pilot stature in the eyes of colleagues, negatively impacted their own self-perception and ultimately affected their career prospects (Elish 2018). Thus, more insight is needed to understand how to foster agency in human-AI interaction to mitigate the consequences of reduced agency. Or as Applin and Fischer put it succinctly “In order for this [human-robot] cooperation to succeed, robots will need to be designed in such a way that the ability for humans to express their own agency through them is afforded” (Applin 2015).



## Agency in Conversational Interfaces

Conversational interfaces have emerged as an increasingly ubiquitous means to facilitate human-AI interaction through natural-language and can be found in many popular consumer applications like Siri, Alexa and Google Assistant as well as in business applications like customer support, banking and HR. While conversational interfaces attempt to make interaction with AI easier through human-like dialogues, they often lack the cues like facial expression or body language that are so critical to facilitating effective human-human interaction. This increases the risk of reduced agency because a person has less information to know when to speak, what to speak and how to speak to their artificial conversational partner - three constraints necessary for successful human-human conversation (Gibson 2000). Numerous studies show conversational interfaces embodied with additional human-like characteristics like in virtual avatars foster more agency than text or voice alone (Appel et. al. 2012; Astrid 2010). These observations reflect individual and proxy agency which were discussed in the literature review - that is, humans need both sensory feedback and the feeling they can socially influence others to effectively interface in conversation. Given that conversational interfaces replace the human element with the artificial, designers must consider how to foster shared conversational agency in conversational interfaces. To date, little research specific to voice-only interfaces exists and thus this case seeks in-part to deepen understanding of the space.

## FOUNDATIONAL WIZARD-OF-OZ RESEARCH

### Research Goals

To inform the design and development of the VUI for drivers, foundational research was proposed before software development began which had three primary goals. First, the research aimed to identify the information and actions drivers desired in a full-fledged VUI to inform engineering requirements and the long-term product roadmap. Second, it sought to capture how drivers would behaviorally interact with the VUI - would they speak more slowly, loudly and clearly, interrupt voice prompts or physically lean or glance toward it - to inform the VUI's visual, sound and conversational design. Third, given that VUIs are still a developing technology, the research aimed to gauge driver tolerance for voice recognition errors to influence the design of error-handling and prevent them in the first place. Understanding the impact of the VUI on driver agency was not an explicit goal. Rather, the chosen methodology and resultant findings described later in this case revealed it as a critical mediator of driver interaction with the product.

### Methodology

Given the highly interactive nature of VUIs and dynamic context of driving, a one-hour in-car wizard-of-oz (WoZ) study was chosen to gain insight into driver behavior and attitudes toward the proposed Uber VUI as naturalistically as possible. In a WoZ study, a human 'wizard' simulates the functionality of a working software artifact out of view of participants, leading them to believe they're interacting with a real product. For the WoZ, an in-car on-the-road setting was selected to better ground the research in the context of drivers

and increase the fidelity of observations. However, the in-car setting and lack of a functioning prototype in Uber's driver application required significant deviation from a typical WoZ to be successful. After evaluating multiple setups, it was determined a 2x2x1-inch nano bluetooth speaker placed inconspicuously in the driver's car and connected to a text-to-speech (TTS) wizard interface could believably simulate voice interactivity in the driver application (see Figure 1). With the interface, which was built using HTML and Javascript, the wizard could inconspicuously act as the voice and respond to driver questions and requests to the VUI. To make these interactions smooth and believable, the interface had canned responses for anticipated queries like *"what's the airport queue"* or *"contact support"*. The researcher-wizard could also initiate voice interactions with the driver by sending prompts through the interface like *"incoming message from rider, how would you like to respond?"* or *"new trip, say yes to accept"*. Furthermore, an open-text field on the interface could be used to craft custom responses to unanticipated questions or requests. To maintain the illusion of a functioning VUI while crafting custom responses, a *"one moment please"* canned utterance was played. The open-source Web Speech API TTS engine powered the wizard interface and had a default standard American-accented male voice which was used during the study.

Twelve drivers - six each in New York City and Chicago - were selected to participate in the WoZ. The two cities were chosen based on their large populations, dense urban cores and diversity in cultures. To recruit participants, a random subset of drivers in each city received an email invitation to the study with details on its purpose and timeframe. Those who expressed interest in participating then completed a brief survey to self-report gender, native language, length of time driving on the Uber platform and previous experience using voice interfaces. This information was used to select a diverse participating cohort to ensure richer insights. Selected participants were then contacted by phone to confirm their participation and instructed to meet the researcher with their vehicle at a predetermined public parking lot in their city. Participation was voluntary and drivers were compensated for their time.

To set up the WoZ in participant vehicles, the researcher sat in the front passenger seat and mounted an Uber-owned smartphone pre-installed with the driver application to the front console. To add voice interactivity, the nano-speaker was placed inconspicuously in the vehicle and connected to the wizard interface on a laptop via bluetooth. Additionally, because the driver application interface was not actually controllable via voice, the researcher needed to physically manipulate it at certain moments to move the trip flow forward e.g. swiping the start trip button. To overcome this limitation and preclude questions about the purpose of the nano-speaker, the participant was told the VUI was a prototype and not yet fully integrated into the driver application. The researcher then signed into the application with a test account so the participant could drive three simulated but realistic Uber trips around the city during the one-hour study period. Participants did not pick up any actual riders during these trips but drove each one as they typically would. Finally, a GoPro camera was mounted on the vehicle dashboard to record sessions for later analysis.

With setup complete, the researcher requested the first ride of each session using an internal trip simulator tool. After a few seconds, the request appeared on the driver application with the researcher simultaneously clicking on the wizard interface *"incoming trip request, say accept or decline"*. Drivers listened and then used voice to accept the request with most saying *"yes"* or *"accept"*. The researcher then physically tapped the navigation button on the application to move the trip flow forward and display directions to the simulated rider

pickup location. During the whole trip flow—pick-up, driving and drop-off—drivers were encouraged to think about what helpful information or actions they might ask of the VUI in addition to the de facto interactions of accepting, starting and ending a trip with voice. Some of the open-ended queries drivers asked included “*call Uber support*”, “*call my rider*” and “*take me to a busy area*”. VUI-initiated interactions like “*New message from your rider, I’m on the corner of market and second street, how would you like to respond?*” were also used to prompt drivers. Several errors were introduced during each one-hour study to gauge driver tolerance for them. For example, a driver might say: “*tell my rider I’m five minutes away*” and the researcher would subsequently introduce the error: “*Sorry, I didn’t catch that. Please say again*”. At the end of each one-hour session, the driver was debriefed on their experience with the VUI and informed of the WoZ setup.

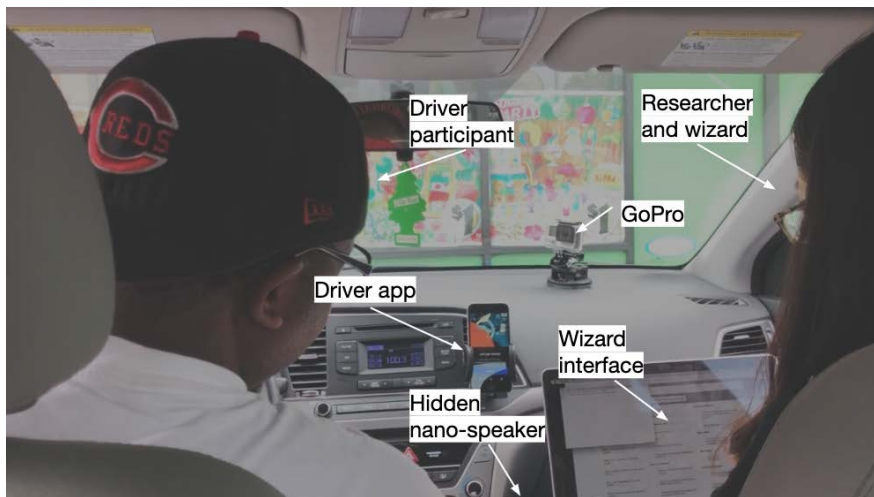


Figure 1. In-car WoZ setup.



Figure 2. Nano-speaker used to simulate voice interactivity.

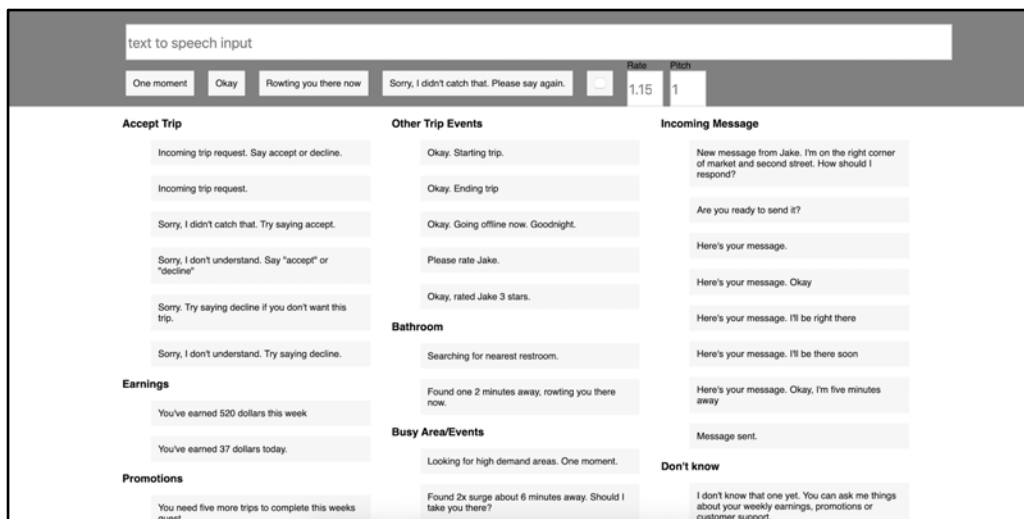


Figure 3. Wizard of Oz interface.

## Findings on Agency

Insights gained from the WoZ revealed agency as a critical mediator of driver interaction with the VUI. The first piece of evidence supporting this was the observation that drivers frequently interrupted the VUI when it spoke, especially during VUI-initiated interactions. For example, the VUI would suddenly say, “*New trip request, s...*” and the driver would interrupt with “*yes*” before it could finish speaking. This ability to interrupt a VUI is known as barge-in and requires the technical ability to respond to a user request while simultaneously listening for interruptions—a complex feature to implement. Barge-in is supported in some commercial voice products like Alexa. That drivers barged-in reflects their need to have conversational agency—the feeling they can influence others in conversation to achieve their objectives, regardless of whether ‘others’ is a human or machine. Thus, fostering agency in VUIs through features like barge-in becomes critical for a good user experience. Based on this finding, it was hypothesized that launching an Uber VUI without barge-in functionality would likely reduce driver agency and consequently lead to its disuse. Accordingly, the researcher began to make the case to the engineering team to prioritize barge-in for the MVP VUI despite the significant technical investment - a process discussed later in this case.

The WoZ also identified the use of the VUI in social contexts as potentially impacting driver agency and product usage. This was learned during the session debriefs in which some drivers reported they might feel uncomfortable speaking and responding to the VUI in front of riders. While drivers would generally control when to speak to the VUI, given the way the Uber platform works, they might receive VUI-initiated prompts for trip requests or rider messages for their next trip while on the current one. The reduced willingness of some to use the VUI in this social context is likely due to the perceived stigma of talking to an artificial agent in front of other people which several studies confirm is a common phenomenon (Milanesi 2017; Moorthy 2014). It was hypothesized that if drivers did not

have the option to disable VUI-initiated interactions in this situation, it could reduce their agency and lead to disuse. However, because the insight was gained through self-reporting and no actual riders entered the vehicle during the study, it was determined the feature would remain on with riders in the car during the alpha research phase to validate the hypothesis.

## ALPHA RESEARCH PHASE

### Overview of the MVP VUI

The WoZ revealed agency as an important factor to consider in designing the VUI. However, to reduce time-to-market and quickly validate the value of the VUI before further development, a limited MVP was built enabling drivers to accept or decline trip requests using their voice. When a request arrives in the standard driver application, a card pops up providing key information about the trip such as time and distance to the rider. If the driver decides to accept, they tap the request card. If they want to decline, they either tap an x-icon or let the request expire by doing nothing (see Figure 4). The MVP does not remove tapping but adds voice as an additional modality to accomplish the same task. When a request arrives, the MVP prompts *“new trip, say yes to accept”* followed by an audible beep to cue the driver to speak. Drivers then say *“yes”* or other affirmative statements like *“accept”* or *“okay”* to accept and *“no”* or *“decline”* to decline. An oscillating white bar at the bottom of the request card provides visual confirmation the system is processing the utterance (see Figure 4). As previously mentioned, drivers did not have the ability to turn off the MVP in front of riders to help validate whether they would disuse it in a social context. Additionally, barge-in was not built into the MVP due to the significant technical effort required to build it. This resulted in drivers having to wait for the VUI to finish saying *“new trip, say yes to accept”* before they could respond or else the microphone would not capture their utterance. Lacking barge-in and the option to turn the VUI on or off in a social context was predicted to reduce usage of the MVP, however, the product team ultimately decided the tradeoff of building the functionality was not worth the delay in time-to-market. This is a common tension in industry between research and product in which teams often ship digital products fast to learn and iterate quickly sometimes at the cost of a perfect user experience. In this case, the researcher acknowledged the need to ship fast and validate the MVP and turned it into an opportunity to run an alpha research phase to collect real-world insights and further strengthen the case for prioritizing agency.

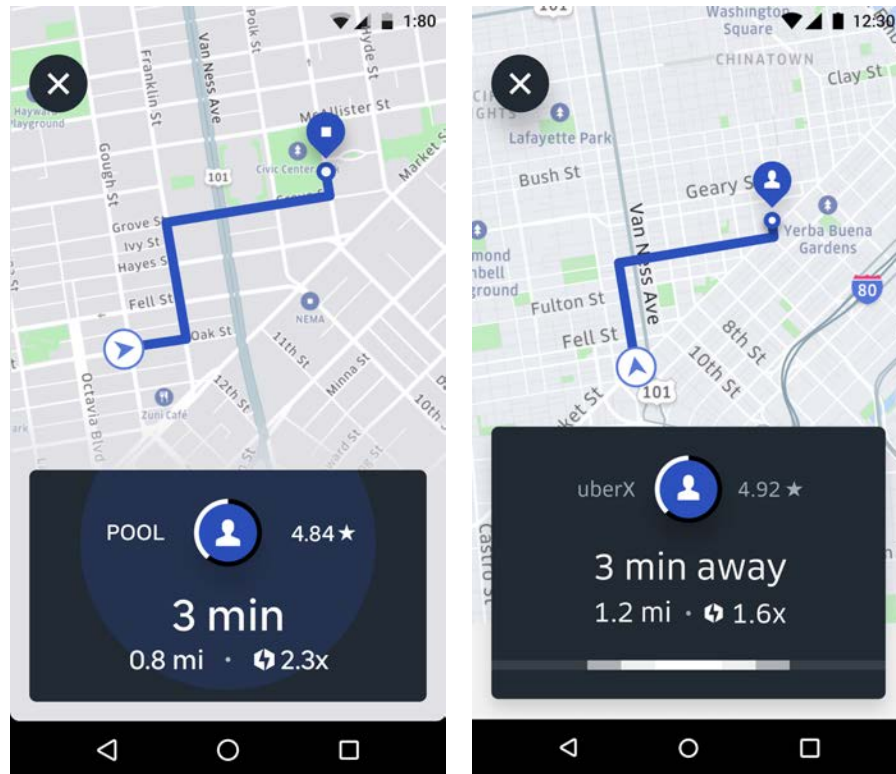


Figure 4. Standard trip request card on the left showing key trip information. To the right is the VUI request card with white listening bar at the bottom.

## Methods

To gain real-world feedback on the MVP and validate the WoZ findings on agency before a wider release, an alpha research phase was initiated. Alpha research parallels the software engineering concept of the alpha release in which a rough version of software is made available to a small group of internal technical users to evaluate its stability and quality. Similarly, alpha research tests with real users within the context of a qualitative research study gaining feedback on a product's experience, not just its functionality. 38 drivers were recruited in the San Francisco Bay Area to test the MVP on real Uber trips for a two-week period. During that time, the MVP was turned on for all participating drivers. However, they were not required to use it and could still tap to accept trip requests if they desired. Providing both modalities generated real-world data that could be used to analyze agency's impact on usage - if drivers faced reduced agency in interacting with the VUI, they could tap. Similar to the WoZ, participants were diverse in native-language, gender and time on the Uber platform. A real-time SMS feedback channel, survey and semi-structured interviews were used to triangulate and strengthen findings.

## Findings on Agency

Analysis of the qualitative and usage data from the alpha research confirmed that a lack of barge-in reduced driver agency during interactions with the MVP VUI and consequently their usage of the product. In some cases, drivers interrupted the voice prompt leading to their utterances not being captured. Others, who correctly waited to respond to the VUI, reported feeling stressed given the limited time to accept or decline requests. For example, one driver said in an SMS message: “[I’m] anxious...waiting for prompt so not to miss trip opportunity. Once I get a trip offer, I start saying Accept, Accept, Accept until she responds”. Those reporting this diminished agency demonstrably reduced their usage of the MVP over the two weeks. This real-world evidence validated the barge-in-agency hypothesis from the WoZ and convinced the engineering team to prioritize building it for the next iteration of the product.

The feedback from drivers who used the MVP in front of riders was mixed. Some were neutral or even excited to use it in a social context. Others described it as “awkward” or mentioned being naturally shy which led them to disuse the feature in that situation. This individual variability reflects drivers’ judgement of agency which was discussed in the literature review - that is agency is not simply a physiological phenomenon but one also influenced by a person’s context information, background beliefs and social norms. Because these traits vary by person, some drivers did not actually experience reduced agency from using the VUI in front of people while others did. Given that drivers still had agency in using the touch modality to accept or decline trip requests, the team decided the engineering effort to disable the feature in a social context was not necessary for the wider release of the MVP. Nevertheless, building the ability to turn the VUI on and off depending on the situation remains a goal for the team in the long-term.

Analogous to the impact of individual variability on perceived agency, it was learned that driver perception of the VUI’s personality could also impact agency, a factor not identified during the WoZ. This ascription of personality to an artificial agent is a widely recognized phenomenon known as anthropomorphism. Given VUIs transmit information in natural language, demonstrate contingent behavior and play a social role through autonomous assistance, they are especially likely to elicit anthropomorphic responses from humans (Reeves & Nass 1996). In fact, multiple studies find increased customer satisfaction in conversational interfaces when they are more human-like (Araujo 2018; Waytz 2014, ). To mitigate the risk of users perceiving a VUI’s personality in unintended ways, it’s recommended designers invest time in formulating and testing a persona for it. In the case of the Uber MVP VUI, the team aimed for a neutral tone but made no significant effort to intentionally formulate its persona due to lack of resources. Nevertheless, the alpha research revealed drivers negatively perceived the MVP when declining trip requests. Specifically, they reacted to it saying *“okay, we will let this one pass”* after declining a trip request. Drivers described the phrase variously from “sarcastic” and “snarky” to “stern” and “authoritative” alluding to a perceived imbalance in the power dynamic between them and the VUI. Despite the reality of having full control, drivers faced a reduction in their proxy and collective agency by feeling less able to influence and work with the VUI. As a result of this finding, the team changed the utterance to simply say *“trip declined”* and more importantly onboarded a VUI designer to initiate a separate line of research to define and validate an intentional persona.

Two additional studies conducted in India and Australia months after the alpha research confirmed the previous findings in different cultural contexts and validated the value of barge-in which was ready on iOS devices. In India, reduced agency remained an issue due to the lack of barge-in functionality on Android devices which all participants used. In Australia, all participating drivers used the iOS version with barge-in and reported increased agency and satisfaction. One driver described his experience using barge-in saying “*A good thing I noticed is the minute it came up, you could say yes, you didn't have to wait.*” As far as using the MVP in front of riders, drivers in Australia had mixed feelings similar to those in the US. In the case of India, the majority of drivers reported not being shy about using it in front of riders. While the reason for this disparity is unclear, it raises a larger question of how different cultural norms might influence agency in human-AI interactions - a topic ripe for exploration. Finally, since changes to the VUI's decline trip response had been made before the studies in India and Australia, no drivers perceived its persona negatively.

## **SELLING STAKEHOLDERS ON AGENCY**

The WoZ and alpha research established agency as an important factor for the VUI's success and surfaced the need for specific features to foster it, especially barge-in. To convince product and engineering stakeholders to prioritize it, three strategies were employed. First, video of five drivers interrupting during the WoZ multiple times was stitched together and shown to the product and engineering teams. Additional video captured during the US alpha research reinforced barge-in's potential value to the user experience and helped convince the team to commit to building it. The use of video as both a storytelling and evidence device proved more powerful than the researcher reading driver quotes or telling what happened and is recommended for practitioners trying to convince teams of the importance of fostering agency in their products. Best practices learned include keeping videos brief to hold stakeholder attention, using evidence from multiple users and ensuring the videos are shareable so teams can rewatch and share them to a broader audience beyond formal presentations.

The second convincing strategy connected agency to product usage - a business outcome all product stakeholders care about. Figure 5 shows the actual slide presented to the product and engineering teams to argue for barge-in framing it as “supercharging” the feature with multiple discrete benefits like reduced waiting anxiety and a lowered learning curve. Furthermore, agency was referred to as control, a more easily understood concept. Framing barge-in in this way connected the VUI's success to agency and helped spur the team to commit to building it. Practitioners are encouraged to similarly tie agency to business outcomes like product usage to more easily convince stakeholders of its importance.

The third strategy was to directly involve software engineers and other product team members in the research. For example, during the alpha phase, three engineers participated in semi-structured interviews with drivers hearing first-hand how reduced agency affected their experience with the product. In one instance, a driver described their experience to an engineer saying “*I wasn't really sure when it was working and started to panic.*” Though engineers do not typically participate in user research at Uber given their imperative to focus on coding, including them in the research proved especially effective at convincing them to prioritize agency-supporting features like barge-in. One lightweight approach to encourage engineer participation was inviting them to observe interviews through remote video-conference. To



do this, the researcher placed optional invites on engineers' calendars and when a session started, posted the video-conference link to the team's internal messaging channel as a reminder. In one instance, an engineer, who had previously participated in a session, strongly urged his colleagues in the team messaging channel to view them. The researcher also invited the engineering team to a small subset of the scheduled interviews based on their potential to generate interesting insights which the researcher tried to predict from participant screener responses.

## Barge-in will supercharge feature

**Insight**

"[I'm] anxious...waiting for prompt so not to miss trip opportunity. Once I get a trip offer, I start saying Accept, Accept, Accept until she responds." - SF Partner

**Why Barge-in?**

- It's analogous to the learned behavior of immediately tapping a dispatch
- It reduces waiting anxiety
- It gives control to the user
- It lowers the learning curve
- It allows for longer, more helpful prompts




Figure 5. Slide presented to product and engineering teams to argue for barge-in.

## DISCUSSION

This case described a novel implementation of the WoZ method which uncovered agency as a critical mediator of driver interaction with a proposed VUI for Uber's driver application, presented three factors that impacted agency and provided learnings on how to convince stakeholders of the importance of agency to the user experience. For the WoZ, the in-car setting and lack of a truly functioning prototype required the researcher to act as both wizard and facilitator and slightly deceive the participant about the nature of the setup. While deception is inherently necessary to run a WoZ, researchers should evaluate the ethical implications regardless of the low risk of not telling participants they're in a simulated experience in most cases. The WoZ is also gaining respect as a viable ethnographic tool and proved invaluable in identifying the importance of agency in the Uber VUI project. This case study along with the use of the WoZ in other recent ethnographic work like Osz and Stayton's studies on autonomous vehicles (Osz 2018; Stayton 2017) show it should be seriously considered by researchers exploring human-AI products. In the case of the Uber research team, this was the first use of a WoZ to evaluate futuristic technology. Barriers to earlier adoption were primarily technical with limited engineering resources available to create high-fidelity wizard interfaces for research only. The logistics of running a WoZ in a

moving vehicle further raised the barrier to entry. Nevertheless, the use of the WoZ in this case piqued the interest of some researchers on the team with one subsequently conducting an in-car WoZ focused on maps and navigation. Researchers in industry are encouraged to think of creative ways to implement WoZs if facing similar limitations.

Three factors were found to impact driver agency during the WoZ and alpha research: conversational agency, usage in social contexts and perception of the VUI persona. To exercise conversational agency, drivers interrupted the VUI and reduced their usage of the accept-decline MVP when barge-in functionality was not supported. Interestingly, the need for conversational agency was greatest during VUI-initiated interactions. While the reason behind this was not explored in this research, it likely relates to a lack of shared agency established between driver and VUI. As mentioned in the literature review, collective or shared agency is essential for groups to complete objectives together successfully. In this case, drivers did not feel that the VUI was a true partner yet. Fostering such shared agency will be critical to successful human-AI collaboration and practitioners in industry are urged to think deeply about how to do so in their products. For the Uber VUI, the team is considering future features like voice personalization. For drivers uncomfortable with speaking to the VUI in a social context, agency was reduced leading to disuse of the accept-decline MVP in front of passengers. Thus, companies are strongly advised to consider how the different contexts in which their AI products will be used might impact agency and subsequently user behavior. Finally, negative perception of the VUI persona when declining trip requests caused drivers to feel like they did not have influence over the VUI (proxy agency) or that it was a collaborative partner for them (collective agency). Organizations should thus consider how users will perceive their conversational interface products and strive to intentionally design and validate personas for them.

In general, researchers and designers of AI technology should account for agency early in the product development process. While it can seem abstract and inconsequential, the ramifications of ignoring it can directly impact the user experience and eventual business outcomes. Paying attention to agency early also gives researchers ample time to convince product and engineering teams of its importance. To convince these stakeholders, this case suggests researchers use video, connect agency to business outcomes and involve engineering and product directly in research. Ultimately, this case study underscores the need to better understand how to foster agency in emerging AI technology. Drivers showed they would reduce their usage of the Uber VUI when they felt diminished agency. And while some insight into how to mitigate this in conversational interfaces specifically was provided, whole new interaction paradigms and strategies will be needed for the wide range of advanced AI technology on the horizon.

## CONCLUSION

As AI technology becomes smarter and more capable, individual agency will yield to a more collective one shared between human and machine. This reconfiguration begs many questions. Will people willingly accept less control? How might people and AI work well together? How might designers foster agency sharing? This case begins to answer some of these questions. It describes the use of the WoZ method as a valid ethnographic means to evaluate agency in proposed technology pre-development, provides insight on factors that impact agency in VUI interactions and details three strategies for communicating the

importance of agency to a cross-functional product team in a major tech organization. Most importantly however, it demonstrates that agency matters. Drivers showed they would not accede to the role of subordinate and disused the VUI when they felt less agency in their interactions with it. Designers of AI technology should take note and strive to balance the agency embedded in the logic and algorithms of their creations with the need for users to have their own agency. Erika Stayton sums up this tension perfectly saying there's a "*strange polysemy at the heart of autonomy: one may be freed from certain tasks but also further embedded in sociotechnical systems that are beyond individual control*" (Stayton 2017). Researchers and ethnographers in industry are uniquely placed to bring a humanistic perspective to the development of these sociotechnical systems and inspire their organizations to foster agency in their newfound technological wonders. Doing so is business critical.

**Jake Silva** is a User Researcher at Uber. His research focuses on conversational interfaces, customer care products and log-based quantitative methods. He received his Master of Science in Information from the University of Michigan School of Information and Bachelors from American University in Washington, DC. Email: [silva@uber.com](mailto:silva@uber.com).

## NOTES

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## Speculative Futures inside Corporate Realities

BEN KUESTER, *Allstate*

MEGAN PRESCOTT, *Allstate*

*The auto insurance industry is being disrupted by insurtechs that are leveraging data and technology to solve pain points in parts of the customer journey, while emerging technology in adjacent industries threatens insurance as it currently exists. As a result, insurance companies are imagining futures beyond traditional insurance and new ways that they might meet the needs of future customers. In order to explore what a reframing of insurance as “protection” could mean to customers, we utilized ethnographic methods and speculative design practices to reimagine how the transition from non-driver to young driver and from dependent child to independent adult could be more fully supported by an insurance company. In this case study, we review both the methodological processes and summarize learnings and opportunities critical to applying ethnofutures and speculative design practices within a large corporate setting, including: proposing a new approach to a diverse group of stakeholders; negotiating near- and long-term priorities; articulating the linkages between current and future states; and developing rich stimuli to create an immersive future in the context of time and resource constraints.*

### INDUSTRY CONTEXT AND INTRODUCTION

Through discovering and anticipating customer needs and pain points, insurance startups, or insurtechs, have been disrupting the industry by leveraging data and technology. The startups that grew up during the beginning of this digital era have a fundamental competitive advantage over much larger, legacy companies that came into fruition in the early to late 20<sup>th</sup> century. By quickly adapting to consumers and markets through new methods and technologies, these young companies have disrupted industries across the board, including insurance. They are able to move faster than their resource-rich predecessors, employing lean start-up and agile methodologies, evaluating the customer on the front- as well as the backend, and creating truly differentiated experiences that evolve and respond over time.

Perhaps modeled after Google, Amazon, Facebook, and Apple’s expansion into all aspects of life, perhaps based on the realization that the status quo is no longer enough to provide sustainable growth, historic companies have been expanding into adjacent spaces in their respective industries. As companies in adjacent industries start to overlap, it provides both opportunity, and additional competition, which, in the insurance industry threatens the existence of insurance as it exists today. As a result, insurance companies are imagining futures beyond traditional insurance and new ways that they might meet the needs of future customers by envisioning scenarios that extend their value beyond current offerings. For Allstate, part of this process is reframing itself as a data and protection company (Morgan 2019) and figuring out how to leverage the data and capabilities it has to deliver a differentiated experience.

Change isn’t new to Allstate. Started as a line of tires for Sears, Roebuck and Company, the iconic brand has evolved over the years. Originally, the first direct to consumer insurance policy, modeled after its parent company’s mail order model, Allstate once included a line of cars and scooters, has been a leader in telematics for over 10 years, and most recently piloted

a new car sharing startup (Drift), acquired a data privacy company (InfoArmor), and purchased a personal device warranty company (SquareTrade). One could argue that Allstate has been ahead of the curve on playing in adjacent spaces to its core business of insurance, but only recently has it looked to broaden the scope of insurance itself to that of holistic protection with a greater focus on customer-centricity.

Over the past several years Allstate has built up internal capabilities around being customer focused including starting to adopt human-centered design practices and building customer and user experience groups. But with 80 years of history comes expected constraints with regard to both culture and agility. To use a common analogy, Allstate is the large aircraft carrier to the jet ski of an insurtech—large and steady but doesn't change course quickly.

Culturally, Allstate is relatively conservative, not unlike many large corporations. There are a lot of different departments, often with different goals, which means cross-company initiatives can be difficult. Technology has also been a constraint. Like most large, decades-old companies, Allstate has gone through several major transitions as new technology has been introduced, but also depends on legacy systems. Although some areas of the organization have embraced agile, test and learn practices, the adoption of these new consumer-centric ways of working hasn't been universal. In addition, regulatory departments tend to take a more conservative stance when addressing large financial services institutions due to their size and market impact.

## **BUSINESS CHALLENGE AND PROJECT CONTEXT**

As Allstate expanded its position to become both a data and protection company (Morgan 2019), leaders sought to better understand how to fully support customers both within the insurance journey and in their broader lives. This evolution to a data-enabled “protection” company seemed to create a new wave of questions about how to leverage data to solve for customers’ latent and unmet needs in this broader context: *What do our customers need? How can we provide them greater value? Where is it expected or appropriate to support in their lives?*

From the previous ways of working, where solutions were sometimes developed before understanding consumer needs, these new questions felt like a revelation. In the current case study, our business partners had both long-term strategic and near-term tactical objectives; they sought to bring together disparate young driver initiatives across the organization (including product coverages and discounts, corporate relations programs, telematics solutions, and digital experiences) and articulate a strategy to more holistically support young drivers and their parents in the transition from non-driver to young driver. Using data to create additional value—beyond coverage—during the young driver life stage in the insurance experience was a way to achieve typical business objectives—grow the customer base, retain them, and appropriately assess risk—while transforming the brand.

In order to achieve both strategic, future-oriented objectives, we proposed ethnographic methods and speculative design practices to reimagine how the transition from non-driver to young driver and from dependent child to independent adult could be fully supported by a protection and data company. While parents may seek to circumscribe teens’ independence, for instance through tracking and surveillance features embedded in cars or smartphones, the company sought to support *both* parents’ and teens’ goals and needs as teens transition

toward becoming a young driver with greater independence. Immersive and extreme futures were created to prompt teens to consider how omni-present, automatic communication through human computer symbiosis could affect their sense of self, relationship to family, notions of risk, and aspirations of freedom. By asking parents and teens to explore futures at the extremes, it was possible to identify preferable futures for both teens and parents, orient near- and mid-term action, and inform a strategy to support personal mobility experiences during this life stage.

The project was supported by a design researcher and conceptual designer (the authors of this case study). Specifically, we remined existing market and user research, completed a mobile diary study with parents and teens, and two rounds of speculative design concepting and consumer feedback to explore both non-insurance concepts that could holistically support a young driver experience and concepts within the insurance product space. In total, 18 teens and 20 parents participated in the study. Following data collection and analysis, the cross-functional team articulated a “north star”—a vision of a future young driver experience—as well as near and medium-term steps toward that vision. The overall objective was to articulate a young driver strategy that connected with parents’ and teens’ goals and needs and articulated and aligned near- and medium-term actions with the longer-term vision (Figure 1).

#### creating white space for feedback and debate to inform strategy

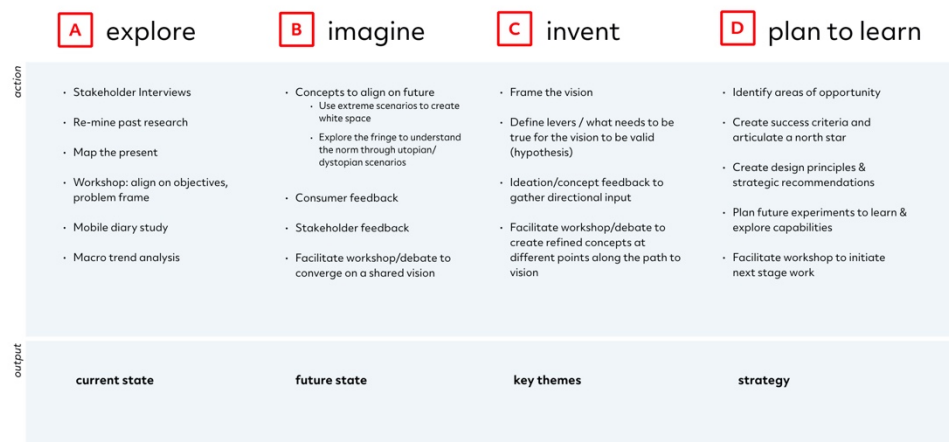


Figure 1. High-level overview of project.

The project brought together new stakeholders from various parts of the organization, including multiple product groups, consumer marketing, product positioning, and telematics—many of whom had not collaborated with user experience or each other. Gaining alignment about strategic work proved to be difficult, as stakeholders from different groups had different goals and priorities. While some stakeholders were focused on a longer-term strategy, other members of the cross-functional team were tasked with near-term



action. They sought to understand, *what do we do with the existing products and features that we have* and *what features provide value to customers?* Thus, some stakeholders were anxious about going through a process to design the farther future when they really wanted to know what they could execute in the next couple months. As a result, we needed to negotiate multiple goals and were constrained by relatively short timelines.

## MAPPING THE PROCESS

As we considered methods and a process that would create both the far and near terms within our short timelines, speculative design (and subsequently its counterpart ethnofutures) immediately came to mind. This was due to a couple of factors. One of the key distinctions of speculative design as compared to traditional design is the goal of designing for how the world could be and asking questions to determine opportunity areas (Figure 2).

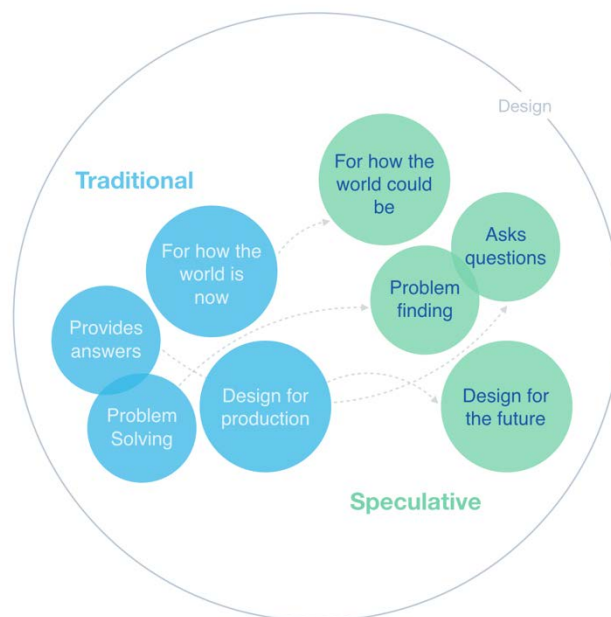


Figure 2. Diagram to explain the difference between traditional design and speculative or future design (adapted from Dunne and Raby 2013).

Our business partners were interested in creating a vision that holistically supported the teen driver experience. They wanted to define an ideal future state that would be a true differentiator, if Allstate chose to pursue those opportunities. The speculative design concepts allowed both the business partners and consumer participants to explore what it would mean for an insurance company to more broadly support this major life change beyond providing an insurance product, including utilizing telematics. The teen/parent relationship is emotional in general and can be especially so with regard to learning how to drive. By focusing on these emotional moments, we were able to get rich feedback that

provided a comprehensive understanding of where and where not to play a role in this transition.

To kick off the project, we worked with the market research team to mine existing marketing and user experience research that had already been done. The previous market research provided attitudinal data from both parents and teens. However, much of it was 10 to 15 years old, and was more focused on parents' attitudes and experiences over teens' feelings and experiences. We also conducted stakeholder interviews and examined previous initiatives and solutions to support parents of teens during this life stage, attempting to understand why previous solutions had failed and how current features are utilized by customers. In particular, unsuccessful digital solutions to support this life stage were designed for parents of teens without consideration of teens' experiences, or were designed for teens with little consideration of the parents'—the paying customer—needs. We hypothesized that successful solutions and strategies needed to accommodate both parents' and teens' goals and needs, as well as articulate with both parents' and teens' emotions, especially given macrorends in the teen experience, including driving at a later age, greater anxiety, greater parent involvement in teens' lives, and greater dependence on mobile technology.

In order to gather additional data on the experience of having (parent) or being (teen) a young driver, we launched a mobile diary study among teens and their parents. This provided in-the-moment (or close to in-the-moment) qualitative feedback on experiences related to learning to drive, including completing practice drives (Figure 3), receiving/giving driving feedback, driving with friends, negotiating greater independence, experiences when a parent has said no to a request to be out of the house with friends, among other topics. The diary study lasted 10 weeks and consisted of a "check-in" every two weeks for a total of five prompts/touchpoints with participants. Five permitted teen drivers and one of each teens' parents, and five licensed teen drivers and one of each teens' parents were recruited. Check-ins were written to be appropriate for the participant's role and/or place in the process and allowed the same events to be understood from a teen's perspective and from their parent's perspective. This research approach provided rich insight into the emotions of teens and parents, helped us to build empathy with the people going through this life stage, and drove ideation with stakeholders that was rooted in human goals and needs (to be discussed).

After initial analysis of the mobile diary study, a workshop was held with the cross-functional group of stakeholders to include them in the process of data analysis, build alignment throughout the process, and incorporate their feedback and ideas into future concepts. We created video collections around salient themes that emerged from the data and asked stakeholders to jot down notes and discuss them—emotions, new learnings, pain points or other details that struck them. Then we structured an ideation around the parent and teen needs (Figure 4). The ideas generated in these sessions carry over as one layer in the futuring process. For example, just as we extrapolate current technology into the future, we take near-term ideas from stakeholders and imagine how they can be pulled into the future as well.

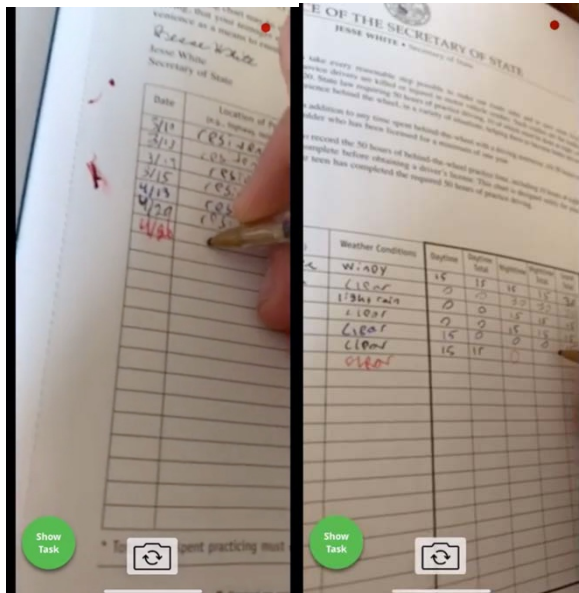


Figure 3. Screenshots of a permitted teen participant filling out his driving log after a practice drive with his parent during a mobile diary study check-in.

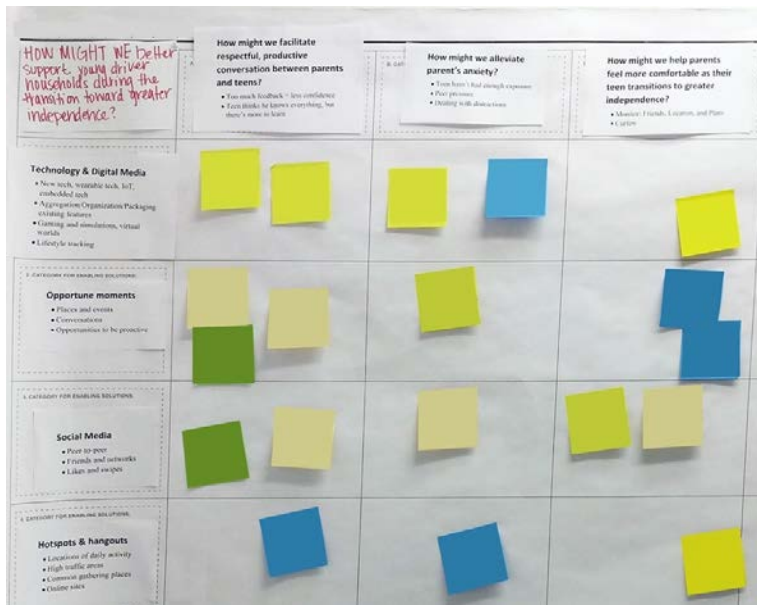


Figure 4. During a workshop, stakeholders watched video compilations from the mobile diary study in order to empathize with parents and teens. Next, parent and teen needs were used as inputs into a structured ideation. Content (ideas) from the sticky notes have been removed. Photo credit: Ben Kuester, used with permission.

In addition to emotional and behavioral insights from the mobile diary study and ideation sessions with internal stakeholders, the creation of future concepts depended on “signals of change” (Lueck Avery et al. 2019) identified in a mining of secondary research on macro-trends, shifting values, and emerging behaviors. One of the core tenants of speculative design is making sure future concepts and stimuli fit within the realm of the possible. This was accomplished by extrapolating what currently exists in the present-day using macro-trends and “signals of change” to project what is possible in the future. This is an important consideration because the future concepts shouldn’t contain fantasy. However, the intention is to push concepts beyond just what is probable. In fact, doing only what is probable is the consequence of a culture driven by near-term release dates, and it takes away any need for having a vision or strategy.

The future has infinite possibilities and it is through decision points that a desired outcome is achieved. Secondary macrotrend research was leveraged to identify a broad range of relevant categories including, but not limited to: technology, politics, society, environment, and economics. For example, we considered how technology and economics might influence driving in the future including envisioning augmented reality and safety elements of autonomous cars, the sharing economy, and a decrease in car ownership, and incorporated these into concepts (Figure 5).

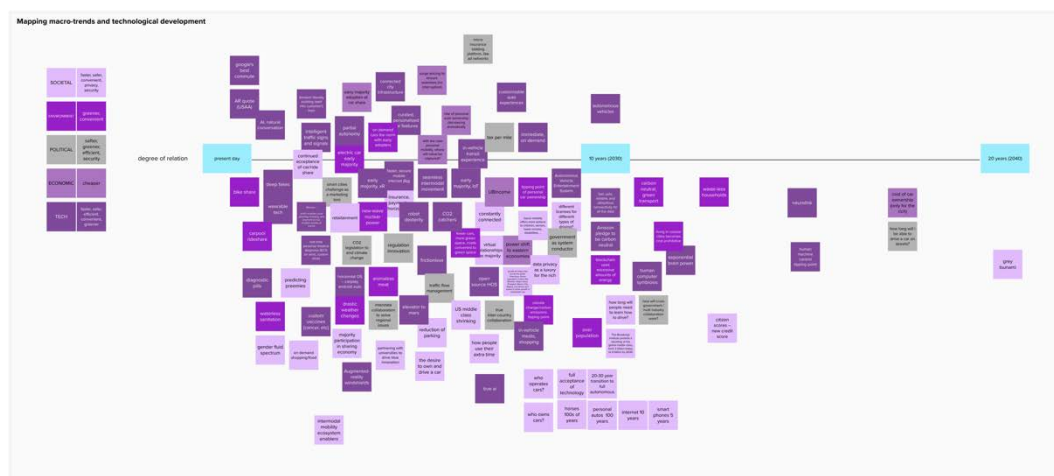


Figure 5. Macrotrends from five broad categories including: societal, environmental, political, economic, and technology, collected through secondary research and organized around potential year of impact.

In creating futures we sought to explore diverse scenarios that tackle reoccurring themes we heard from the initial mobile diary study. In order to do this, we organized the various inputs for future concept development using different themes as axes of matrices to assess how inputs fit together. Each axis is evaluated at the extremes to ensure all perspectives are

considered. Each quadrant of the four-square represents one of four possible scenarios within the space of the two themes being evaluated.

Two big themes that emerged during the diary study were teen independence during the transition from permitted to licensed teen and communication between teens and parents. We evaluated the former from low independence to high and the latter from in-person, in the moment communication to fully automated tracking (Figure 6).

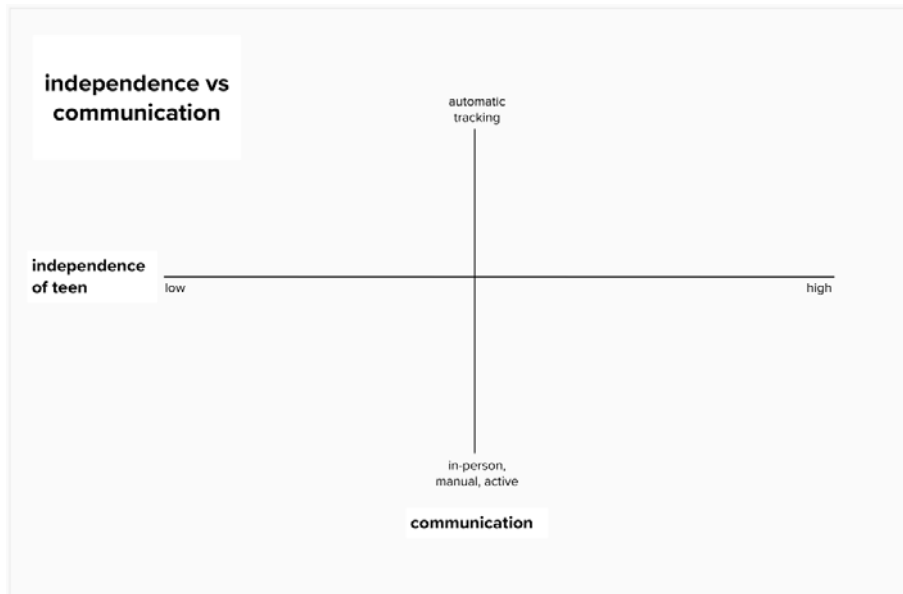


Figure 6. Axes used to connect multiple layers of input. Each axis was evaluated at the extremes of themes that emerged from the mobile diary study.

Next, parent and teen needs identified during analysis sessions were plotted onto the matrix followed by ideas from workshops with stakeholders. Related stickies across each layer were clustered together as the process unfolds (Figure 7). Once all workshop ideas were placed, they were adjusted to be appropriate for the established time period, and—if needed—pulled into the future, as mentioned above; in this case, we aimed to imagine a future seven years out. Finally, macrorends pulled from our collection of secondary research and conversations with internal experts were incorporated. In an ideal state, interviews with external experts on a regular basis could help fill out our library.



of parents and teens from urban areas, most participants came from suburban areas. Here, a more sophisticated recruit became a compromise in the process to fit within time and budget constraints, as we used a low-cost online platform specializing in speed but lacking the capability for a highly specialized recruiting.

Each session had dedicated time for an interview about their current experiences learning to drive if it was a teen, or helping a teen learn to drive if it was a parent, as well as concept immersion and feedback. By eliciting consumers' current state experiences in an interview first, we were able to immerse them into the concepts and stories in a deeper way (Figure 8). In the end, this was very effective. During this part of the session, participants were asked to put themselves in the shoes of one of the characters in the storyboard—either Sarah, the teen driver, or her mother, if the parent. Throughout, we asked the participant to read and process the story out loud, talking through not only how they were interpreting pieces of the story, but also how they felt about Sarah and her mother's interactions, and how elements of the story compared to their current experience. We asked them to call out similarities and differences, challenging them to imagine how elements of the future concept would change their experience, impact their emotional state, or the effect it might have on their relationship with their parent/teen. The initial current state interview combined with the story map stimuli allowed us to successfully immerse the participant in the stimuli.

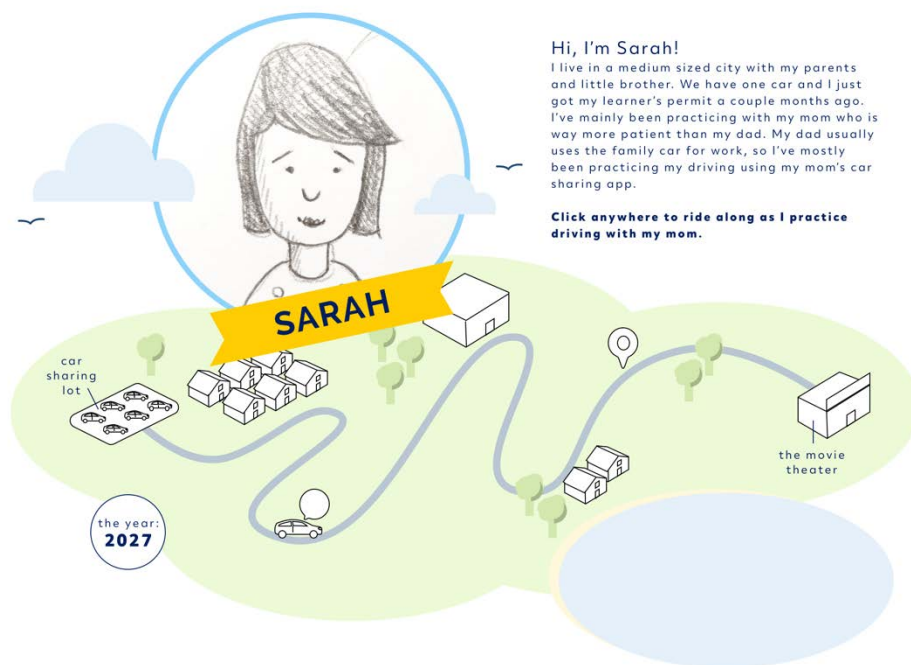


Figure 8. A clickable story map about Sarah and her mom was created as immersive stimuli for future concepts. As participants clicked through the story, storyboards were used to illustrate—frame by frame—specific experiences and concepts.



Participants were immersed in both utopian and dystopian future concepts. Acting upon the advice of Lueck Avery et al. (2019) the dystopian concepts were meant to push participants into uncomfortable spaces—to identify the boundaries of comfort of using data and technology to facilitate an experience. In many cases, the parts of the concepts that elicited strong emotional responses were surprising. For example, many parents discussed their fears, not just about their teens’ safety while driving, but their safety and decision-making when out with the “wrong crowd.” When we visualized solutions for that problem within the scenarios where technology enabled the parent to monitor and circumscribe their teen’s mobility based on who was with them in a car, and even allow the parent to flag their teen’s peer as not a good influence, parent participants had negative, visceral responses to the lack of agency granted to the teen (Figure 9). They imagined an inability for the teen to develop good decision-making skills and establish trust with their parent without the ability to make choices. In fact, parents had a stronger negative reaction than teens.

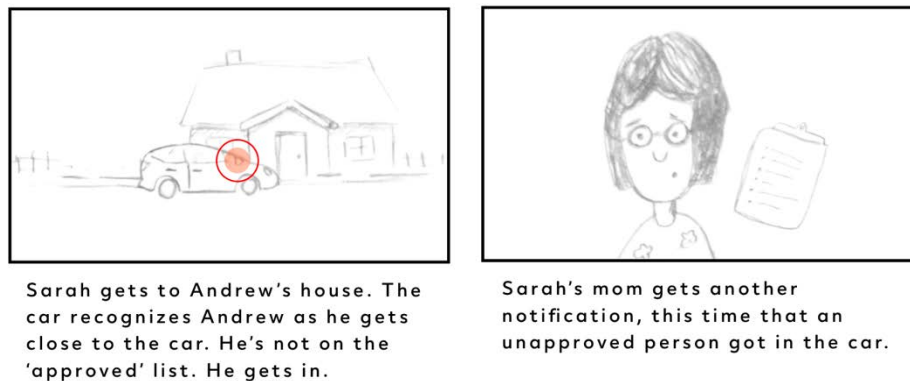


Figure 9. Parents and teens responded to dystopian futures to establish their personal boundaries with surveillance and tracking technologies in the young driver context. This future was designed to push participants into uncomfortable spaces as opposed to elicit feedback on a concept that would go into market.

*“This is Orwellian. [...] [Teens] need practice making good decisions; they need to be allowed to practice.”*

—Linda (parent), reacting to a concept in which teens’ mobility was circumscribed if non-approved friends entered the vehicle.



Two rounds of concept feedback with parents and teens were completed. While the first round was focused on exploring ways to holistically support the transition from non-driver to young driver, the second focused more narrowly on exploring new models of insurance. This was one way to address both near- and longer-term objectives. In each round, elements in the current state were developed to a farther future state, a customer value proposition was outlined, and the customer experience was represented within the story map that functioned as our stimuli.

After each round of concept feedback, a debrief or analysis session with stakeholders was conducted. Once again, it was helpful to include key stakeholders at multiple points in this process. This not only establishes buy-in and trust along the way but also provides an opportunity to collectively align on main ideas, themes, and ultimately a shared vision.

## **FROM FEEDBACK TO INSIGHTS: UNDERSTANDING HOW TO SUPPORT THE PARENT/TEEN RELATIONSHIP**

Conducting ethnographic research with parents and teens helped us envision future concepts that brought together macro societal trends and technological developments to articulate with more stable consumer goals and needs. For example, through understanding the transition from non-driver to young driver from both parent and teen perspectives, concepts were designed to mediate the tension between parents and teens during practice drives and support the broader parent/teen relationship that is critical to the longer-term transition from dependent child to independent adult.

Although parents' and teens' experiences varied, a certain amount of tension was always present during the practice drives of permitted drivers and their parents. Beyond creating negative emotional experiences, the parent/teen relationship hindered the actual learning that was intended to take place in these hands-on sessions. Parents were accused of being "nit-picky" or too reactionary. Teens were accused of being too sensitive to criticism, overly anxious about their driving, or too confident about their skills and knowledge. The way parents deliver feedback, the timing of the feedback, and the amount of feedback resulted in many teens complaining about the effectiveness of their parents' teaching strategies. To solve for this pain point, future concepts leveraged data-enabled technology to replace the role of the parent during these practice drives. However, the concepts weren't pushed far enough to make either parent or teen uncomfortable. Both groups emphatically described how different and more positive their experience would be—and subsequently how much stronger their relationship would be—if the future solution were available today.

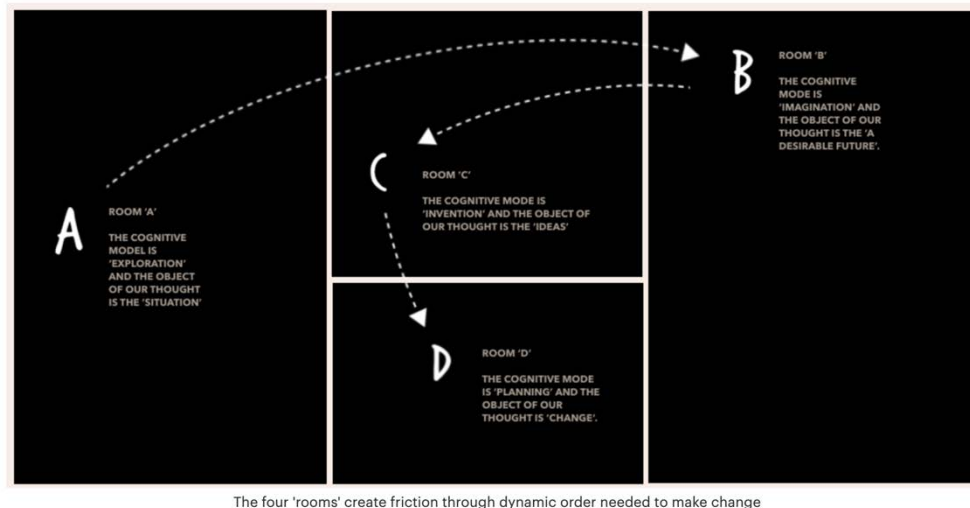
The agency and independence of the teen was essential to both parents and teens. Despite parents' expressing discomfort with their teens' decisions and a desire to have greater control over their teens' lives (including where they go, who they go with, and why they go out), when presented with solutions that delivered such surveillance and control to parents, parents immediately recognized the solutions as preventing teens from having the opportunity to practice making good decisions, demonstrate their maturity, and ultimately build trust with their parents. These concepts helped parents articulate values that weren't otherwise expressed during the contextual check-ins about their experiences. In other words, speculative future concepts helped us understand the boundaries of the preferable future and imagine solutions that articulated with parents and teens deepest goals and needs.

## ARTICULATING A “NORTH STAR”

One of the goals of this project was to articulate a “north star” or a vision of what the young driver experience could and should be in the future. The AcdB framework (Figure 10) was used to help illustrate the use of speculative design and articulating far-future states in order to work backward to understand both a path toward the future state and near-term actions to take to get there. Again, while the framework served the business partners less, it helped us map out a process at the beginning of the work and provided an anchor to keep us oriented throughout the project. Here, the research to explore the current state young driver experience constituted Room A. The concepting to explore the utopian and dystopian futures were within Room B. Also, within Room B, preferable futures were identified and aligned on in the form of experiences, products and features to support the young driver experience, and the parent/teen relationship more broadly. The constellation of experiences, products and features constituted a “north star” that would orient near- and middle-term actions.

After completing both concept feedback sessions, key opportunity areas that align customer needs and technological capabilities were identified. A journey map was used to articulate the teen and parent journey. Lanes for parent and teen behaviors and activities, emotional states, needs, and pain points were incorporated. The insurance touch points—albeit few—that a consumer would have with their insurance company during the young driver transition were also mapped. The research-based journey map allowed us to align on the current state experience and provided a visual reflection point for the missed opportunities to support in people’s lives. After completing an ideation against the current state, the cross-functional team clustered ideas around broader opportunity areas. Based on discussion, four opportunity areas were aligned on to prioritize. This was based on the biggest pain points and the most emotional parts of the process for both parents and teens, as well as the ability to evolve the existing products, services, and features to a future vision. Knowing that the far future is not certain, this vision is treated as a “north star”—something to align to and aim for, but at the same time something that can be adjusted as time goes on. Even with this understanding, it still enables the team to execute near- and mid-term actions as a part of a cohesive strategy.

A bridge was imagined between the future and current states, outlining tactical steps backward from the future based on feasibility (Room C). In this process, the key opportunity areas remained constant while imagining how to play in the near-, mid-, and long-terms. This process helped filter out noise of all the things Allstate *could* do, to help align stakeholders on what *should* be done now and in the mid-term to achieve a strategic vision (Room D). In doing so, a strategy and holistic customer experience were outlined—a preferable future—that would differentiate Allstate’s offering from competitors, as well as accomplished both the near- and long-term goals of the project.



The four 'rooms' create friction through dynamic order needed to make change

Figure 10. The AcdB framework from Second Road (part of Accenture) articulated a process that provided structure to a speculative design practice aimed at addressing near- and far-future objectives. This image is from the 2<sup>nd</sup> Road website (see References Cited).

Throughout the process, stakeholders asked, “*Who are we designing for—the parent or the teen?*” This was an appropriate question, as the parent is the paying customer, but it was important to not create solutions or experiences that make teens feel bad during the learning process or the subject of restrictive surveillance. Moreover, the team maintained that a successful strategy would depend on experiences and solutions that helped *both* teens and parents achieve their goals. While the key opportunity areas were focused on supporting the parent needs and parent/teen relationship, the design principles functioned as guideposts to creating a positive teen experience.

## PROJECT OUTCOMES

The project concluded with a final share-out to the group of stakeholders that were engaged throughout the project and the strategic vision went to leaders to be considered for prioritization. The strategic vision also supported the case for a different funding model—from project to program budget—that would allow not only for the creation of new features and experience but their longer-term support and iterative development. Due to prioritization of other enterprise initiatives, a large investment into developing the parent/teen young driver experience has not yet been prioritized. However, the project did help the team re-evaluate the current offerings—how they are positioned and packaged, and more clearly articulated the value they can offer teens and parents. Near-term and low-cost repositioning and enhancements remain a priority, and the business partners are passionate about further developing a young driver experience as a strategic opportunity to differentiate Allstate’s offerings in the future.

Another outcome of the work was buy-in for farther-future concepting and research to inform near-term actions that articulate with a strategic vision. In fact, the successful collaboration with business partners in this project paved the way for subsequent ethnofutures and speculative design projects. In this way, this work strengthened the partnership and trust between our research and design departments and new areas of the business that we are now supporting. In the future we would like to push the speculative design practice to incorporate more immersive futures.

## **PATHMAKING: SPECULATIVE DESIGN IN CORPORATE CONTEXTS**

We set out to apply new methods—speculative design and ethnofutures—to help Allstate think in a different way, create an aligned vision for a holistic young driver program, and to start to live into the organization’s goal of becoming a protection company. We worked with new stakeholders, some of which weren’t accustomed to working with a human-centered, iterative approach. We also took several large steps toward figuring out how speculative design and ethnofutures can be leveraged as an input to strategic, product/service decision-making. Did we stumble along the way? Yes. But ultimately, in large part due to the trust and patience of the business partners, we were successful in creating a shared vision and getting buy-in for future work. To conclude, we offer six tips to others attempting to institute a speculative design and ethnofutures practice in a large corporate context with similar constraints.

### **1) Focus on the on stakeholders’ objectives**

In our excitement to pilot ethnofutures and speculative design practices in the young driver project at Allstate, we made several missteps. We were too concerned about getting buy-in on the methods and process. We insisted on outlining and diagramming the theoretical benefits and methodological process and missed the point for our stakeholder, which was developing a strategy that mapped near- and long-term actions and supported the young driver transition. We communicated in visual representations (Figure 11) when our stakeholders were more comfortable working in Excel. We emphasized the farther future, not the near future. And we neglected to draw the connection between speculative design and the experience concepting and research that we were already doing successfully and on which we had built our credibility. As a result, we failed to get alignment on using ethnofutures and speculative design to explore an even larger, more holistic project and wasted several weeks trying to figure out how to tell the story of speculative design to a new audience. It turns out, we were telling the wrong story.

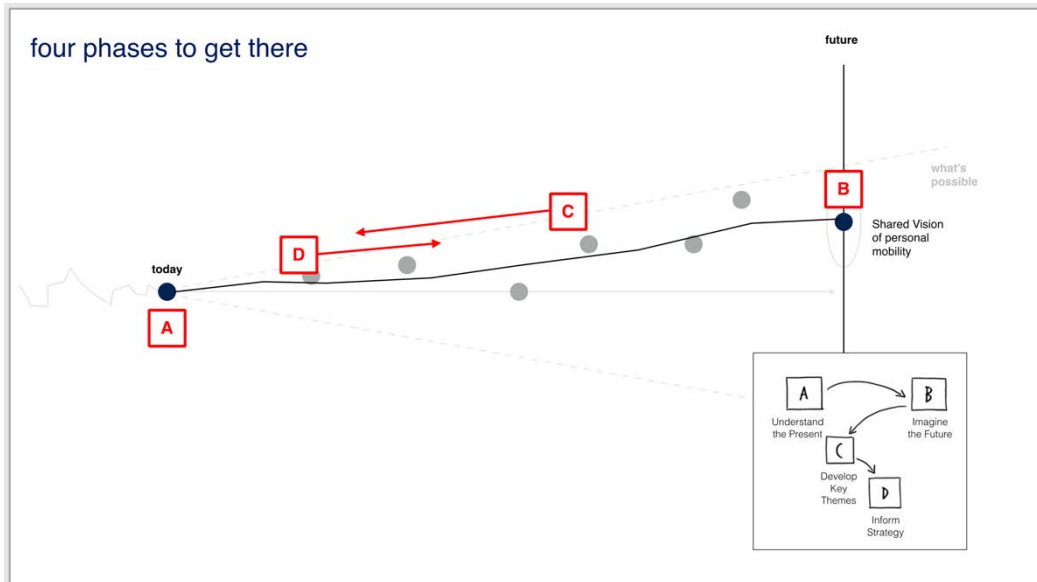


Figure 11. While pitching this work, we spent too much time trying to get stakeholders to understand the method and process. Pictured is a slide from a pitch deck illustrating the connection between the AcdB framework to speculative design.

## 2) Invest in recruiting the right participants

Recruiting via an online platform specializing in low-cost and speed resulted in tradeoffs in the ability to be more targeted in the recruit. We did our best to test with “the extremes”—people that personified the macro trends and already engaging in emerging behaviors (particularly early technology adoption). However, we sacrificed a more complicated recruit (from a potentially larger panel) that would have required participants to fulfill multiple macro trend-related criteria (urban-dwelling, decreased vehicle ownership, delayed age of driving, etc.).

Likewise, participants should be able to relate to future concepts as a result of their current, present day life. The relevance of this guidance is dependent on how universal the experience is that the future concepts address. In the present case study, all participants were navigating this experience in their daily family life. However, in a subsequent study in which some of the concepts reflected more specific and niche experiences, some participants did not have comparable experiences in the present day. While they still were able to provide feedback, it was imagined and hypothetical, and less rich overall, as they were not able to reflect on their current state experience and emotions. In other words, it lacked critical ethnographic elements.

## 3) Fictive storytelling can stand in when more elaborate immersive futures are out of reach, especially when addressing emotionally charged experiences

While adapting speculative design to the organizational culture, the approach was compromised in several ways, all of which were related to both resources and speed. Because

pitching the work wasn't easy to begin with, we didn't pursue requests to create more immersive, and probably more expensive future (a model car, virtual reality experience, or other installation). Fictive storytelling created immersive futures in an extremely rapid and low-cost way. Because the future concepts reflected upon highly charged current state experiences, participants were able to immerse themselves easily and had strong responses to both utopian and dystopian futures. Despite the compromises, the work was successful in creating stakeholders who champion the work, and a holistic and strategic framework to guide prioritization and action.

However, in a subsequent project, speculative design and ethnofutures research was applied to less personal and low-emotion experiences exploring the concept of "convenience." While still productive in facilitating conversations about what the future could be, it was more difficult to elicit emotional responses from either utopian or dystopian futures. As a result, we hypothesize that a more immersive future experience may be useful to elicit stronger emotional responses when the experience is inherently less emotionally charged.

#### **4) Build confidence with new partners incrementally**

This was a new way of thinking for many of the involved business partners. Because of this it was particularly important for us to incrementally build their confidence. This included inviting stakeholders into the research and design process using multiple design thinking activities with the intention of fostering empathy, creativity, and building alignment. First, video of research sessions helped stakeholders empathize with parents and teens and invited stakeholders into the process of data analysis. It was easier for stakeholders to discuss the biggest opportunities when they had a shared understanding of the consumer pain points and emotions. Second, throughout the engagement stakeholders were invited to provide input about questions they had and incorporated these into either the diary study or the concept feedback sessions. Third, we led the stakeholders through creative solutioning and incorporated some ideas—or the essence of the ideas—into the future concepts. Inviting stakeholders to participate in all parts of the process helped create a sense of shared ownership, helped create progressive alignment, and helped build our stakeholders' confidence in the process.

#### **5) Work toward transforming the relationship from client to partner**

Despite business partner and stakeholder support, designers and researchers are shared services and their relationship to stakeholders is often conceptualized and experienced as one of a vendor/client. While we brought our stakeholders along throughout the process, their participation was limited by time and competing priorities. Thus, there was little participation in interviews and debriefs. Likewise, while stakeholders contributed to the business strategy, the business case did not live within the project deliverable in a formal way; that part was documented in other deliverables. In future engagements, we will aim to bring the human-centered future experience, together with the business case, and potentially a more detailed articulation of the technological dependencies and investments needed to step toward that north star experience. A systems perspective would aid in road-mapping and help the team move more quickly to execution.

In addition to us lacking a technologist, we might also have benefited from partnering with our colleagues specializing in competitive analysis. Again, while we discussed both feasibility and the competitive landscape, we didn't truly "partner" in order to articulate the strongest business case. Thus, while we brought together a diverse group of stakeholders for this work, forming more complete partnerships that will allow us to tell a more holistic story and make a stronger business case is an opportunity for future engagements.

## **6) Iterate: each project is an opportunity to learn.**

As is evident in this case study, the young driver project was not perfect in execution or even situated within the most ideal context. Timeline constraints and a lack of funding for the creation of a more immersive physical or virtual futures meant the method was adapted and, in some ways, compromised. The application of the methods in the young driver work can be considered a pilot of these adaptations and compromises to explore how an ethnofutures and speculative design practice might be established at Allstate.

First, we needed to iterate on our pitch to stakeholders. In fact, the young driver project was the second pitch proposing the use of ethnofutures and speculative design to strategic work in the company's product space. In the first proposal, near future objectives were not closely tied to the farther future objectives and we were ultimately unsuccessful in garnering the support to drive that work forward. Second, we iterated on the fly during concept research. When concepts that were meant to make consumers uncomfortable were not successful in eliciting fears and other emotional responses, some parts of the concepts were revised to push them into more dystopian spaces until we found the consumers' boundaries. Finally, as discussed, we iterated from one project to the next, applying what was successful and iterating on the parts of the process that were less so. We took every opportunity to create hypotheses about how to best adapt the methods, evaluate the outcome, revise the hypothesis and iterate.

## **CONCLUSION**

Reflecting on the project and process as outlined in this case study, balance has emerged as a theme. When pitching a speculative design and ethnofutures approach, we needed to find the right balance between establishing the credibility of these new practices with showing value through simply delivering the desired outcomes. When creating the concepts, we had to find the right balance between stakeholders' goals and our own goals of piloting an ethnofutures and speculative design practice. This meant being flexible and experimental but doing everything possible to preserve the integrity of the methods. As this was a first foray into supporting more strategic work at Allstate, we also were searching for a balance among desirability, feasibility, and viability. While we provided valuable insights and strategy regarding desirability, and we often discussed technological feasibility and market differentiation with our stakeholders, it would have been richer to have told a more holistic story via the formal inclusion of other strategic elements in the final deliverables. This was a critical opportunity for future engagements and to make ethnofutures and speculative design more valuable as a tool at the company.

As organizations seek to work in an agile way—adapting to emerging and evolving customer needs—researchers and designers must also evaluate how they work to support this agility. We are fortunate to work with stakeholders who are open to listening to and learning from customer feedback in general, but also open to being introduced to new practices including speculative design and ethnofutures. To be successful in developing test and learn products and experiences, we must take the same lens to our methods and how we work together.

**Megan Prescott:** Sociocultural anthropologist and design researcher Megan Prescott informs the design process through her curiosity about people, methodological expertise, and storytelling. Through various methods and techniques, she seeks to understand human behavior and help teams empathize with consumers, which both inspires ideation and directs intuition. As an instructor for design thinking methods, she evangelizes human-centered design. [meganmprescott@gmail.com](mailto:meganmprescott@gmail.com)

**Benjamin Kuester:** Transdisciplinary artist/designer Benjamin Kuester approaches projects holistically with a data driven mentality. With experience ranging from design to UX, development to emerging technology, and digital video to physically manipulated motion, he consistently strives to take a human-centered approach with everything he creates. [bkuester@gmail.com](mailto:bkuester@gmail.com)

Prescott and Kuester currently work in User Experience Research & Design at Allstate Insurance in Northbrook, IL.

## NOTES

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## Weighing Decisions in Monitoring and Evaluation of Clean Cookstoves

JENNIFER VENTRELLA, *The New School*  
ERIN PEIFFER, *Oregon State University*  
SHAOZENG ZHANG, *Oregon State University*  
NORDICA MacCARTY, *Oregon State University*

*This case study examines agency within monitoring and evaluation (M&E) schemes for international development projects. Specifically, it evaluates a sensor to measure fuel consumption of clean cookstoves as a method of maintaining accountability and soliciting data on stove performance. Despite trends of increasingly automated M&E, the decisions of choosing, analyzing, and translating outcomes and indicators are influenced by stakeholder input. Through various rapid ethnographic methods including surveys and interviews with government agencies, non-profits, and clean stove users, in addition to participant observation and focal follow of stove users in Central America and Uganda, the interactions and inputs of various agents throughout the project lifetime are assessed. Further, it is discussed that while not all actors were equitably engaged throughout the entirety of the project, sometimes as a result of misaligned goals, M&E can be leveraged as a communication mechanism between stakeholders to enable increased engagement and goal alignment.*

### INTRODUCTION

The international development sector spends billions of dollars each year on projects attempting to reduce global poverty and increase quality of life (OECD 2017). Clean cookstoves are just one technology that have been incorporated into development strategies targeting the nearly 3 billion people who still rely on biomass fuels (e.g. wood, charcoal, dung, crop residues) to cook and heat their homes (UNDP 2009). To improve health and reduce environmental harm from traditional cooking methods (e.g. three-stone fires), clean cookstoves were designed with the goal of reducing smoke emissions and fuel consumption by increasing both combustion and thermal efficiencies. To achieve this goal, the Clean Cooking Alliance, formerly the Global Alliance for Clean Cookstoves, aims to transition 100 million households to cleaner cookstoves and fuels by 2020 (Global Alliance for Clean Cookstoves 2015). An essential component of this program is monitoring and evaluation (M&E) to determine to what extent these goals are being met and which has been an increasingly critical element for international development projects. If done properly, M&E can increase user agency in international development projects and improve project success and sustainability.

This case study investigates the development of a sensor as an M&E tool for cookstove usage and fuel consumption in Guatemala, Honduras, and Uganda, and the influence of various stakeholders (users, designers, and development practitioners) in choosing what outcomes and indicators to measure, how to analyze them, and how to translate analyzed data into actions that meet the needs of end-users. The existing power structure within which this case study was conducted is discussed and alternative frameworks suggested. As the researchers came to find, the international development system has the potential to

propagate unintentional misalignment of goals between the complex network of people involved, but it also has the potential to use M&E as an avenue for user agency and multi-sectoral partnership. To foster closer alignment and recognition of user agency the role of ethnographic methods throughout the automated M&E process is discussed. Although this case study is specific to development projects, the process and challenges are generalizable to most companies functioning under a general user-designer-stakeholder model with development work exhibiting extreme characteristics due to cultural divides that can lead to potential disconnections between donor demands, designer-proposed solutions, and actual user needs.

## **BACKGROUND**

### **International Development Paradigms**

Starting with an overview of the structural underpinnings of the international development sector can aid in understanding how it currently operates. The field of international development originated after World War II, during European efforts to rebuild their cities. Following the initial rebuild, some European countries sought to invest their additional funds in revitalizing lower-income countries to increase international trade and thereby gain more control, according to post-development theorists (Rapley 2007). Regardless of the intentions, European involvement and control in outside countries' affairs created an inherently top-down structure, as they were choosing the desired outcomes and development strategies. During the second half of the 20<sup>th</sup> century, local and international NGOs began to develop around this movement of humanitarian assistance and development. These NGOs traditionally sourced their funding from governments and aid agencies who often set internal agendas, further perpetuating the top-down nature of the sector.

Today, the sector has evolved into a complex web of stakeholders, including governments, government aid agencies, private donors, NGOs/nonprofits, academic institutions, and end beneficiaries. Power hierarchies within this web have led to conflicting priorities in pursuit of the intertwined goals of poverty relief and sustainable development. In addition, a lack of viable mechanisms for communicating across cultures and in areas of low or no connectivity has deepened this divide. What can unintentionally result from this disconnected structure is project failure due to a lack of user input and agency. There are countless instances of initiatives that have fallen short of delivering their promised impact. Some examples include the LifeStraw (Boisson et al. 2009), PlayPump (McGrath 2011), One Laptop Per Child (Keating 2009), and India's National Programme on Improved Chulha [stoves] (Hanbar and Karve 2002).

### **Clean Cooking & Fuels**

Despite past difficulties with clean cookstove projects, they remain a prevalent technology in the development sector. The goal of distributing 100 million cleaner cookstoves set by the Clean Cooking Alliance stems in part from understanding the risks associated with traditional cooking methods, which have been linked to a wide array of

health, environmental, and economic problems. To illustrate, picture a scene observed by the research team during fieldwork of a woman using a traditional open fire in rural Uganda. Several times a week, she sends her daughter deep into the bush to search for growingly scarce firewood, which takes several hours per trip. She spends three to six hours a day by the fire cooking for her family, continually inhaling the smoke that becomes a constant cloud in her poorly ventilated kitchen. The smoke that eventually escapes the kitchen will permeate the atmosphere and contribute to carbon emissions. The smoke inhaled by the woman and any of her children will be the catalyst of future lower respiratory infection. Perhaps, with a cleaner stove, the time spent on cooking could be allocated towards something else, like education or an income-generating job. Perhaps the fuel saved from a more efficient stove could help to limit forest degradation. Observations of the potential for positive impacts drive the Clean Cooking Alliance's mission. Ultimately, these impacts are nuanced and context-specific.

Traditional open cooking fires are timeless to human history and deeply ingrained in culture. Cooking and preparation methods, food flavors, and meal textures depend on these existing technologies. If new stove models do not completely consider these cultural contexts, they often go unadopted (Thacker, Barger, and Mattson 2017). However, stoves that better accommodate cultural and/or economic preferences can sacrifice efficiency and sustainability, resulting in similar amounts of smoke and fuel use to their traditional counterparts. Because of such varying social, cultural, and economic constraints and tradeoffs, it is extremely challenging to design a stove that optimizes usability, affordability, and technical performance. For technical performance specifically, it is difficult to predict in-home fuel consumption and emissions from lab-based testing. Monitoring and evaluation (M&E) is one method to help measure, evaluate, and ultimately address the balance of achieving various impacts on the household and community level.

## **CHOOSING OUTCOMES & INDICATORS**

Current automated M&E tools to assess cookstove performance and impact include temperature and emissions sensors to measure indicators including cookstove usage, ambient emissions, and indoor air pollution. While M&E methods in this sector are advancing, there are still gaps. During a twelve-day fieldwork course in Guatemala, two of the lead researchers from Oregon State University (OSU) worked with a clean cookstove nonprofit on the manufacturing and distribution of their stoves into a local community. A few months after the field course, conversations with the nonprofit revealed the need for new M&E methods to report impacts to donors. Included in these selected outcomes were changes in children's school attendance, fuel savings, and time savings. Hearing this, the lead researchers started brainstorming possible ways to measure these donor-driven impact metrics.

Visualizing the practice of cooking from start to finish using field observations from Guatemala, the team decided to focus on firewood, and the idea for a sensor to weigh fuel over time, called the Fuel Use Electronic Logger (FUEL), was conceived. Measurement of fuel consumption is an important metric for donor evaluation for several reasons. First, cleaner cookstoves are intended to reduce the amount of fuel used, requiring both baseline and post-intervention usage data. As previously stated, metrics obtained from lab testing on cleaner cookstoves historically vary significantly from actual field performance (Lombardi

2017). As such, obtaining accurate field data is important to validate the assertion that the new stove saves fuel. Additionally, cookstove usage patterns are far from uniform. Stove stacking, or using multiple stoves (cleaner and traditional), to regularly cook, is common, reducing the effectiveness of stove interventions in terms of both adoption and technical performance (Masera 2000; Masera 2005; Pine 2011). One of the main motivations for the team was, therefore, to contribute to transparency and accountability mechanisms within the sector, ensuring that the proposed performance outcomes were being met. By understanding stove adoption and fuel consumption patterns and the reasons behind these trends, the cookstove sector can begin to move towards more integrative stove designs that more comprehensively meet end-user needs.

## **NEEDS EVALUATION**

### **Stakeholder Needs Assessment**

Creating an economically viable sensor was critical to ensure product sustainability and impact. To understand the proposed sensor's economic viability, the team participated in the Oregon State University Advantage Accelerator Program, the National Science Foundation Innovation Corps, and VentureWell Student E-Teams. Through these programs, the team conducted semi-structured interviews with over 50 stakeholders in the cookstove community with the aim of understanding current gaps in the sector and whether/how the sensor could help fill those gaps. One result of these interviews was a better understanding of the challenges NGOs faced when trying to form a sustainable business model, in addition to other financial constraints that shape the sector.

Using the compiled interview data, the research team constructed a non-profit 'needs pyramid' to depict how funds were being allocated and prioritized in the current system. The needs pyramid was rooted in Maslow's Hierarchy of Needs theory (Maslow 1943), which ranks a set of needs from vital to least vital and posits that if base-level needs are not met, less essential needs cannot be addressed. From this, the team realized that the success of the FUEL sensor required basic non-profit needs (i.e. distribution and logistics, marketing, and qualitative user feedback) to be met before considering quantitative monitoring and evaluation, as shown in Figure 1. Budgets in international development are typically constrained, and therefore most resources are often allocated towards cookstove distribution, the most direct and quantifiable achievement for a cookstove nonprofit. Because of limited funding and a lack of regulatory policy or incentives, rigorous M&E is sometimes not feasible within the current system. When NGOs did conduct M&E, it was often at the direct request of their donor and written into the funding budget (approximately 5-10% of total, if any).

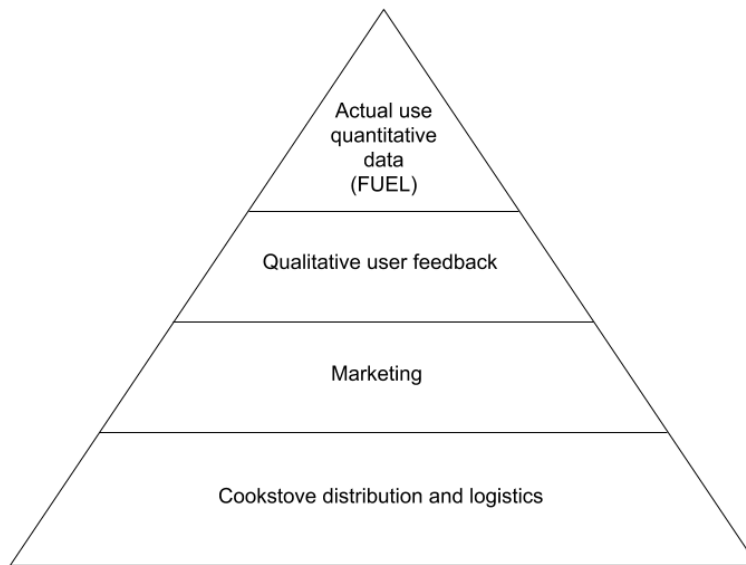


Figure 7. Hierarchy of NGO needs

The resulting hierarchy of needs led to several areas of consideration for the team concerning the purpose of the FUEL-derived data. If used, and once collected, would these data be used to inform donors of project success? If so, why was the metric of measuring fuel chosen as an important indicator and what level of input did end-users have in this decision process? If needed, what would be the NGO's capacity to effect change? In addition, while the metrics FUEL can report are constant, how important fuel consumption is to different stakeholders is variable. How could the FUEL be used to elicit, align and reconcile end-user and donor needs? These questions helped to highlight the differences between end-users and other stakeholders.

Figure 2 shows a representation of the various levels of relative institutional power and the different groups engaged within the development scheme throughout the project lifetime. Power rankings were based on interview data and tracing who made the key decisions for projects, often characterized in terms of money flow. Notably, despite being the focus of this intervention, the end-user often has the least institutional power and, sometimes, least say in the project outcomes. The researchers were faced with the question of how this system could be equilibrated and work to be more empowering and collaborative for underrepresented populations.

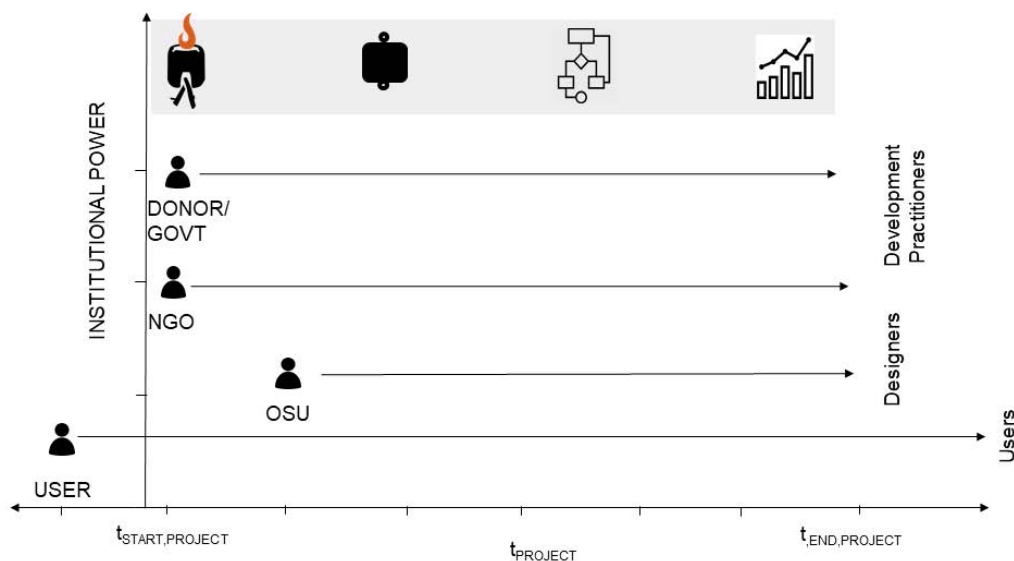


Figure 8. Levels of institutional power throughout the project lifecycle

### Alignment of Various Stakeholder Needs

Illustrative of the institutional power structure outlined in Figure 3, needs may be unintentionally prescribed to end-users by other stakeholders in development projects. For example, studies have shown low demand for clean cookstove technologies with other needs prioritized above reducing indoor air pollution (Mobarak et al. 2012). Although there is clearly still a place for promoting cleaner technologies and longer-scale healthier behaviors even if they are not the first choice or primary concern of the user, practitioners should still consider what other technologies and/or metrics might be more aligned with user needs. These considerations also raise the ethical question of how to identify and prioritize the objectives of multiple stakeholders and how these initiatives can be designed in a way that does not place the majority of the burden to adapt on the end-user. These ethical factors were further contemplated and evaluated as the team began to develop and test the physical product.

### PRODUCT DEVELOPMENT & TESTING

The idea to develop a fuel weight sensor was chosen as it represented an improvement from the standard method of manually measuring fuel at set intervals over a period of time (typically 4-7 days) - a task that is both time consuming and sometimes unreliable (Bailis et al. 2018). Based on these findings, the Fuel Usage Electronic Logger (FUEL) sensor was conceived and designed in partnership with Waltech Systems and Climate Solutions Consulting.

OSU researchers provided initial specifications based on field observations, including a maximum weight capacity, resolution, and data logging rate. The final design utilized a wireless sensor to autonomously log fuel weight over time and a temperature sensor to corroborate cooking events, providing both firewood consumption data and cookstove usage patterns. Figure 3 shows the system installed in a household kitchen. The intent is that a household cook stores a portion of their fuel in the supplied holder and removes fuel as needed for cooking. The load cell logs these mass changes and stores them in its internal memory. An algorithm developed by the OSU research team then integrates these changes in mass to calculate fuel use over time. To test, field studies in Honduras and Uganda were conducted with five and then 100 sensors, respectively, between April 2017 and July 2018. Additional information on the design of the FUEL system is outlined in (Ventrella, Zhang, and MacCarty 2019) and the algorithm and preliminary results from a study in Uganda are described in (Ventrella and MacCarty 2019).

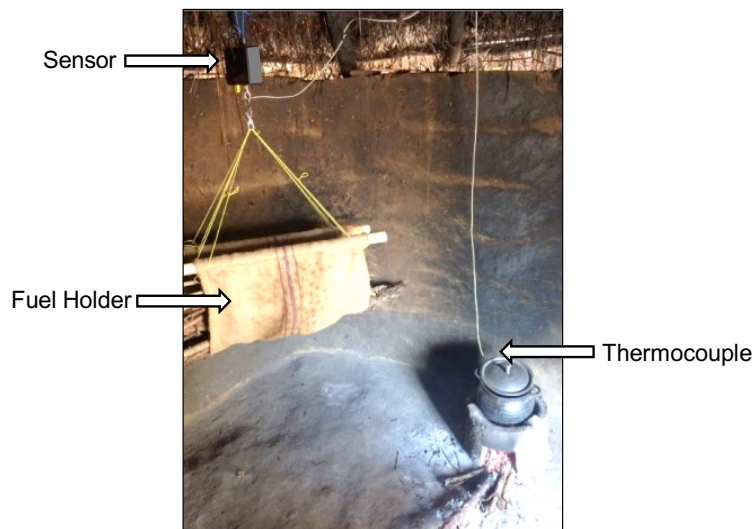


Figure 9. FUEL system in household kitchen (Ventrella, 2018)

## ANALYZING RESULTS

After the studies were completed, OSU researchers developed an algorithm to analyze sensor data in the lab. Raw outputs from the sensor provided a time-stamped log of the cookstove temperature and weight of the fuel in the holder. These raw data were then translated into donor and NGO-driven metrics including fuel consumption, stove usage, and projected tons of CO<sub>2</sub> mitigated. More detail on raw and extrapolated outputs can be viewed in a previous paper (Ventrella and MacCarty 2019).

Upon further analysis, some of the data from the study in Uganda showed peculiar trends. Large spikes in the weight of fuelwood would appear sporadically, and the researchers originally planned to remove these data points assuming they were just noise (e.g. accidental jostling of the fuel holder). Comparing these spikes with insights from a focal



follow of firewood collection and participant observation helped to contextualize the data, as described in a previous EPIC paper (Zhang, Zhao, and Ventrella 2018). The researchers eventually determined that this noise resulted from intentional actions of the cook. From observations, it was not uncommon for women either directly before cooking or during mid-meal preparation to split additional wood and add it to the fire. From the FUEL training, they were told that they could only cook with fuel that came from the holder. As such, women would add and then immediately remove the firewood from the holder to cook, resulting in unexpected spikes in the data. Despite the automated nature of the FUEL, human input, both from researchers and end-users, was essential to interpret the data.

Using this new understanding of how the sensor was being used in practice, an algorithm was created to filter actual noise from these intentional spikes. A later study conducted by the research team showed that applying this cleaning technique increased the goodness-of-fit of the FUEL to manual measurement results from 0.6 to 0.8 (Ventrella, LeFebvre, and MacCarty 2019). Comparison of the FUEL to manual firewood measurements confirmed that the sensor worked and was generally well accepted by stove users. The researchers then had to decide what to do with results from the FUEL.

## **TRANSLATING RESULTS**

Using the analyzed results, relevant metrics were conveyed to the NGO partners indicating that the FUEL sensor was successful in its goal of measuring firewood consumption and cookstove usage patterns. Additionally, the FUEL could enable NGOs to collect more quantitative data on fuel consumption, better understand cookstove usage patterns, and take more informed steps with their project moving forward and to ensure longer-term impacts.

In addition to communicating results to the NGO partners, one priority of the researchers was to communicate the results back to those who had participated in the studies. Although Institutional Review Board (IRB) oversight requires specific actions to be taken before and during the study, there is little to no guidance as to the ethical requirements of reporting data back to participants after the study if the research is not directly health-related. To address this missing feedback mechanism, the lead researcher worked with International Lifeline Fund, a local non-profit in Uganda, to generate both a script and visuals to convey the results of the study back to participants. Figure 4 shows an example of results that will be conveyed to participants, both verbally and using a visual scale. In this case, the amount of fuel used for each combination of stove type(s) used in the study location is depicted in a manner intended to be more accessible for areas with low literacy rates. A previously published paper provides further detail and images of each stove type (Ventrella and MacCarty 2019).



Figure 4. Example of visual results for research participants

Results of fuel consumption measurements from this initial study were positive, confirming that use of the cleaner stove reduced fuel usage. A question that remained was what decisions would need to be made if the results proved otherwise and who would be involved in these decisions. For example, if results showed that there was no decrease in fuel usage, there was low adoption of cleaner cookstoves, short cookstove lifetime, or stove stacking was a major problem, what would be done? The project could be abandoned or the results not addressed, or, in contrast, these results could be considered and lead to positive changes.

There are several examples from the broader sector that demonstrate some of these positive initiatives following qualitative feedback from end-users and sensor-based data. Following user-voiced concerns about cookstove durability, designers have started extensive research on materials and durability to improve the lifetime of cleaner cookstoves (Brady et al. 2017). Cleaner cookstoves have had value added by including thermo-electric generators that power lights and charge cell phones (Wilson et al. 2018), something that may make investing in cleaner cookstoves more appealing to men who typically control household spending but aren't subjected to the daily detriments of cooking with a traditional stove. Others have made context-specific design changes to facilitate the usability of their stove models. These examples represent positive changes that have been made following M&E of projects that embrace user agency.

## FUTURE STEPS: INCREASING AGENCY

As discussed throughout the paper, M&E that engages users throughout the project lifecycle has the potential to elicit user needs and align stakeholder objectives. When done improperly, the solely top-down power structure that is sometimes present in development

projects can be perpetuated. However, designers and researchers can play a role in transcending these communication barriers by actively engaging with end-users and helping to create a space where their insights are included in the decision-making process. While top-down approaches insofar as they include the role of governments, donors, and NGOs are still relevant, they must be integrated with bottom-up, local knowledge.

One step taken to accomplish this on a technical level for the FUEL was the development of a wireless data collector to replace SD cards and help resolve usability issues faster. For example, field staff can now identify issues and work with end-users to solicit feedback, reduce data bias, and brainstorm the next steps to be taken almost immediately. Additionally, the wireless data collector can now be fully integrated with a suite of sensors to monitor fuel use, cookstove usage patterns, and emissions, expanding the number of metrics assessed and allowing for more holistic performance assessment. However, power dynamics are still at play here as the monitoring metrics are not necessarily prescribed by the user. Stronger mechanisms for translating user and sensor-based feedback into useful programmatic strategies are needed. The method of triangulating qualitative and quantitative ethnographic data can certainly help to assess current progress and gaps in development projects, and more resources should be allocated towards this end.

In an ideal world, the stakeholder hierarchy of needs would look quite different, as portrayed in Figure 5. The priority and large allocation of funds would go towards understanding user needs first and engaging with local entities. Once understood, the end-user, designers, and other stakeholders would work together to identify relevant quantitative metrics. These initial data would be informed qualitatively by the end-user. A combination of these qualitative and quantitative data would then inform more effective marketing campaigns, thus reducing the need for late-stage M&E, with researchers acting as cultural brokers to ensure all stakeholder needs and knowledge are incorporated into action-based, long-term project steps. Once a successful market was established, more resources could then be allocated to the distribution of cookstoves and logistics. The FUEL can fit into either hierarchy depending on the use case. For example, if fuel consumption is an identified issue in the area, the FUEL can be implemented early on in the process to determine how much in-home fuel is being decreased and inform marketing strategies, as opposed to the traditional hierarchy where it would only be used at the end of the process mainly for donor reporting.

More organizations are moving toward this market-based structure as they strive towards establishing a sustainable market of which understanding user needs is a requirement. Recently, there has been a trend towards better user engagement in market-based approaches. First steps for this endeavor include engaging with users to better understand current knowledge, attitudes, and practices around cooking using a combination of qualitative and quantitative methods. This partnership-based approach brings together international and local governments, universities, NGOs, and the end-user, with M&E as one mode of communication between each group. For this project, and others like it, the M&E tools deployed over time may need to be updated to more explicitly track user-defined needs. Additional complexity is added as some situations may call for a hybrid approach in which donor-driven and market-based initiatives are combined in the pursuit of a strong future market, with the M&E methods evolving throughout the project lifespan.

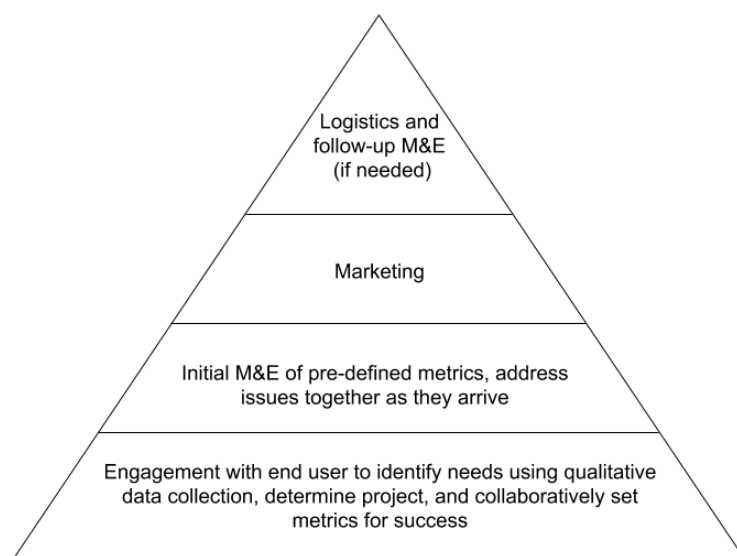


Figure 5. Ideal hierarchy of needs

## CONCLUSION

As the researchers learned during this case study, human feedback informed every step of the automated M&E process. Human-based ethnographic data was essential to selecting outcomes and indicators, designing the algorithm, and interpreting quantitative data. Although the algorithm developed in this study was based on quantitative, non-human collected values, its assessment and true value is derived from human inputs.

While autonomous technologies are often assumed to lead to accuracy, neutrality, objectivity, and transparency that is especially important in the field of M&E, this case study demonstrates that the integration of human inputs enhances, rather than compromises, accurate and meaningful interpretation of data as well as transparency and accountability in M&E.

The demand for rigorous M&E in the international development sector is becoming more ubiquitous. Researchers need to remain conscious of what metrics are chosen to be monitored and allocate resources effectively and efficiently towards those initiatives. This is especially important given the dichotomy between constrained organizational operating budgets and the broad and pressing nature of the issues these organizations must address. M&E that combines automated quantitative and qualitative data and brings together the inputs of multiple actors can help create an avenue for those at the bottom of the institutional power structure to more actively participate.

**Jennifer Ventrella** is a PhD student in public and urban policy at the New School. She recently earned a dual Master's in mechanical engineering and applied anthropology from the humanitarian engineering program at Oregon State University. Her email address is [ventj804@newschool.edu](mailto:ventj804@newschool.edu)

**Erin Peiffer** is a PhD student in mechanical engineering with a minor in applied anthropology in the humanitarian engineering program at Oregon State University. Her email address is [peiffere@oregonstate.edu](mailto:peiffere@oregonstate.edu)

**Shaozeng Zhang** conducts research in applied anthropology and Science and Technology Studies (STS). He received his PhD in anthropology from the University of California, Irvine in 2014. He is currently an Assistant Professor of anthropology at Oregon State University. His email address is [shaozeng.zhang@oregonstate.edu](mailto:shaozeng.zhang@oregonstate.edu)

**Nordica MacCarty** is an Assistant Professor of mechanical engineering at Oregon State University. Her research as part of the humanitarian engineering program is focused on the design and evaluation of clean water and energy projects with particular attention to user considerations. Her email address is [nordica.maccarty@oregonstate.edu](mailto:nordica.maccarty@oregonstate.edu)

## NOTES

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## Caregiver/Family Agency Rebuilding Confidence, Play, Familiarity, and Passion in a Healthcare System

ADAHEID L. MESTAD, HGA

AMIN MOJTAHEDI, HGA

*During recovery and transition to the 'new normal', the loss of agency for patients and families of patients who go through a major health disruptor such as transplant, cancer, or cardio-vascular disease can be profound. Considering this, how can acute care hospitals help solve for caregivers' loss of agency? And what does the physicality of such effort in the confines of a hospital building look like? The goal of this case study is to (1) demonstrate how ethnographic thinking and design research can help a medical center understand the needs, values, rituals, and agency of a patients and their families; (2) show socio-spatial solutions that can support the transition to the patient's and family's new normal.*

*The ethnographic study showed that the patients and families who go through a major health disruptor struggle with the loss of agency in various ways. While loss of agency can be obtuse, four themes emerged as contributing factors to the overall sense of loss: (1) loss of confidence; (2) loss of familiarity; (3) loss of play; (4) loss of passion. The degree of loss experienced was related to the severity of the health disruptor.*

*Socio-spatial design solutions resulting from the research included a significant allocation of family-centric space (e.g., experiential learning for family caregiver education, well-being for family support, and family connection rooms), programs, services, products, and partnerships (to relieve and provide permission) for family caregivers to regain elements of agency.*

*This case study is written before the redesigned protocol and physical space design is completed-and-in-practice. The research to-date, however, was sufficient to persuade the client to commit to redesigning the family/caregiver experience as manifested in the design of the physical space as well as its accompanying protocols.*

### INTRODUCTION

"It's hard when you're trying to see your daughter's graduation ... you've waited 17 years for this day, and you're missing it because you're 1000 miles from home." Mia then pulled out her cellphone and showed the video of her 17-year-old daughter in the graduation dress walking down the hospital hallway. "She graduated. Her daddy missed it. We missed it. So she wanted to walk. You see her coming down the hallway? ... And the nurses, they're playing the pomp and circumstance ... and I was praying that no one would die during that 30 second walk. There would be no emergencies."

Mia's husband, a transplant patient, missed their daughter's graduation ceremony due to his condition. This was not the only thing that had changed for him and his family compared to their pre-transplant lifestyle. Yet, this major disruption had never stopped the family to strive for navigating a new lifestyle, a new "normal". The graduation ceremony was not an exception either. Despite all the limitations, the family with the help of a group of nurses rebuilt this ritual for the father by recreating the graduation ceremony in the hospital hallway.

When it comes to settings in which people experience loss of agency, acute care medical facilities are perhaps at the top of the list. Losing control over conscious execution of freedom of choice and power (Bourdieu, 1977; Giddens, 1984; Berger and Luckmann, 1966) for patients and families of patients who go through a major health disruptor such as



transplant, cancer, or cardio-vascular disease can be profound. Considering this, what can acute care hospitals do to help patients and caregivers regain their disrupted agency and rebuild a new normal? What is the physicality of this effort in the confines of a hospital building? And ultimately, how would such hospitals be different from conventional ones?

In recent years, the playing field for acute care hospitals has drastically changed. The Center for Medicare and Medicaid Services (CMS), a major payor in the U.S. healthcare system, has mandated hospitals to publicly report patients' satisfaction with hospital care as measured by the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS). The HCAHPS survey is intended to standardize collection of patient satisfaction data for the purpose of making objective comparisons across hospitals nationwide, incentivize quality of care improvements, and enhance accountability. HCAHPS measures patient satisfaction using a series of questions categorized under 10 topics covering themes that range from staff communication and responsiveness to cleanliness and quietness of hospital.

However, the big data curated by HCAHPS and other patient satisfaction surveys do not consider or assess the family caregiver experience. Currently, family-centric, standardized metrics do not exist although many healthcare systems identify family-centered care as a highly valued guiding principle. This case study uses mixed-methods approach to demonstrate how ethnographic thinking and design research can (1) help an acute care medical center understand the changes in needs, values, rituals, and agency of family caregivers as they transition to a new normal; and, (2) identify what is needed from the institution to truly support the transition. Specifically, the case study explores the loss of agency within the ecosystem of care and potential design responses to assist in reclaiming agency among family caregivers.

## **CONTEXT AND SETTING**

As part of predesign work for two new bed towers, to be built in a large U.S. city, design researchers from two partnering architecture firms were charged with gathering data and original insights around patient and family experience to generate 'innovative solutions and unique brand offerings'. An interdisciplinary experience design team was formed to investigate the client's current patient experience landscape and generate insights to guide future architectural planning and design work.

At the beginning of the project, the institution identified a total of ten service lines. However, after conducting multiple focus groups and journey mapping sessions, these service lines were framed under three Centers of Excellence for the purpose of focusing research efforts. The three Centers of Excellence included the following:

- Heart and Vascular Institute (HVI)
- Oncology and Immunotherapy
- Transplant

## **JOURNEY FROM BIG DATA TO THICK DATA**

To understand the patient experience, researchers started from studying traditional healthcare standard metrics and big data. However, the review of metrics from HCAHPS

and CAHPS (Consumer Assessment of Healthcare Providers and Systems) along with patient satisfaction scores did not reveal fresh insights or innovative opportunities as they were measuring standardized structure of healthcare delivery and quality of care – all high markings. Suggestions from this initial study included enhancing room size and natural lighting in inpatient rooms. Yet as best practices already established in the field, they were not offering new opportunity or fresh insights that would prompt innovative solutions.

The research team soon realized that to deliver innovative solutions, they must go beyond the industry structure and to gain deep insights into patient and family emotions, beliefs, values, and social systems pertaining to a traumatic health disruptor. Therefore, a mixed-methods approach to collect patient and family experience data was proposed. The research design included ethnographic interviews, participatory methods such as visual listening, and focus groups with patients and families as well as journey mapping workshops and focus groups with providers.

The client institution, however, asked to omit ethnographic interviews with patients and families from the approach and limit the research phase to journey mapping workshops with staff, patients, and families. Being aware of the value of ethnographic and participatory action research for uncovering insights pertaining to patient and family experience; the research team initially agreed to the new plan proposed by the client institution. However, they later used the results from the journey mapping exercise to justify the value of ethnographic field work. The research team did so by showing discrepancies between staff's perception of care journey with that of patients and families.

The research team facilitated staff and provider workshops and guided a market-based research firm, that held a retainer with client institution, to facilitate an experiential journey map exercise. More than 300 staff members, including providers, clinicians, support professionals, and administrators participated in describing their perspective of the patient/family emotional journey mapping. In tandem, the same emotional journey mapping exercise was conducted with 91 patient and families of diverse health experiences, ages, ethnicities, genders, and geographic locations.

Consequently, the research team's analysis of all research activities showed a significant discrepancy during patient and family recovery and discharge – staff and providers perceived a positive experience during these phases of patient journey while patient/family expressed emotions such as anxious, unsure, lack of confidence, overwhelmed during their/loved one treatment and recovery.

Identifying similar insights and moments with innovative potential reinforced a focus to step outside of traditional healthcare metrics and tools to understand opportunities that could support patient and family's confidence, reassurance, and empowerment during treatment and recovery. An updated mixed-methods research design approach was proposed to incorporate ethnography, visual listening, and shadowing observation which lead to key findings in this report on patient and family agency. Finally, a framework comprised of guiding principles and strategies resulting from this effort framed the design and decision making during the subsequent phases of the project.

The following describes the methodology, results, and impact of the study.

## METHODS

Emotional journey mapping was one of the methods used to identify key moments in patient/family's current care journey. During this exercise, data was gathered during a workshop attended by 80 staff members including providers, PAs, RNs, and administrators. The intention was to assess the patient/family care journey as perceived by Subject Matter Experts. During the workshop, participants created five unique patient personas and described the patient/family's perceived journey by highlighting actions, behaviors, and emotions as touchpoints throughout the continuum of care – which included five key phases of understanding, diagnosis, treatment, recovery, and discharge.

In addition to conducting this exercise with staff, a series of emotional journey mapping sessions were conducted with patient/families. These sessions included a total of seven focus groups each with 10 to 18 patients/families from a range of experiences and demographics who belonged to a particular service line. Each patient/family completed an individual emotional journey map which then was used to create a collective service line journey map. Results of staff perceptions of the patient journey were then compared to those of patients.

Aggregated data from the comparison compiled patient/family needs (from patient/family and staff/provider) that informed overall patient thematic design insights based on overarching project opportunities. However, distinct discrepancies revealed in the following two areas motivated the research team and the institution to broaden the scope of their investigation by including family members.

1. For HVI and Transplant, family and patient time during patient recovery that supports lifestyle normalcy and preparing family/patient new normal at discharge.
2. Oncology patients' consultations, procedures, or other aspects of care during treatment and recovery to support lifestyle normalcy.

In framing the value of ethnographic research, it was determined that enhancing recovery and discharge through process improvement was not the solution. To deliver holistic patient and family-centered care, the client institution needed to first understand the overall lifestyle characteristics of patients and families. Only then would it be possible to create ~~new~~ innovative systems that would facilitate lifestyle normalcy during care and educate families on how to adapt to and adopt “a new normal”.

Ethnographic interviews, journey shadowing, visual listening, and observations were the primary research methods used during the targeted research. A total of eight patient/family groupings — two from each CoE (Heart and Vascular Institute, Oncology, Transplant) — were selected. Each ethnographic interview coupled with shadowing interviews of patients and families lasted between three to six hours and began with meeting patients/families at their home, or place of stay, to understand values, rituals, context cues, and lifestyle normalcy before and after the health disruption. Shadowing interviews were then conducted from the time they left their home to the time they either returned to home or left the hospital for a follow up visit.

The quantitative data and the information acquired from tracing patient/family movement during their visit was overlaid, in real-time, with the “thick data” of human behaviors, needs, values, and body language. Finally, visual listening was used, at the

conclusion of the interview, to understand the range of places and experiences that could be incorporated to support patient/family normalcy during treatment and recovery as well as to prepare patients/families for their new normal after experiencing a health disruptor (e.g., cancer, transplant, heart, and vascular disease).

## FINDINGS

### *Journey Map Comparison*

Comparing staff perceptions of patient journey maps to actual patient journey maps revealed a significant disconnect resulting in an “ah-ha” moment for client leadership as they engaged in an exercise to build empathy for patients and their families. Instead of just showing ways to improve the process and workflow, the research team shifted the focus to the “emotions” and the “why”. Later, the results were themed around micro-interactions, hospitality in healthcare, family-centered care, and supporting a new normal during and after treatment. Not only did emotional journey mapping build rapport and empathy between staff, patients, and families, it served as a framework for staff/providers to understand misperceptions and the significant value of patient/family voice in a broader context than quality of care.

### *Normal to New Normal*

An important finding of the targeted investigation was the need to think differently about patient/family-centric care within the client institution. Ethnographic study of families’ role in patients’ overall recovery and lifestyle transition following a major health disruptor revealed caregivers’ struggle with the loss of agency. While loss of agency can be obtuse, four themes emerged as contributing factors to the overall sense of loss: (1) loss of confidence; (2) loss of familiarity; (3) loss of play; (4) loss of passion. The degree of loss experienced was related to the severity of the health disruptor and each loss relates to a spectrum of normal and new normal.

Further analysis indicated a wide spectrum in patient and family needs based on normalcy and new normal across service lines (i.e., Transplant, HVI and Oncology). For example, the need for confidence and new normal were much higher in transplant patients and families than those of oncology patients and families. Oncology patients typically undergo long courses of treatment requiring frequent visits to campus. As a result, they expressed interest in activities and spaces that served to bring normalcy to their time in the hospital. At the other end of the spectrum, transplant patients experienced an intense disruption to their normal lives creating the need to define a “new normal” and associated activities and spaces. Family experiences and needs were especially important for HVI and transplant patients (Figure 1).

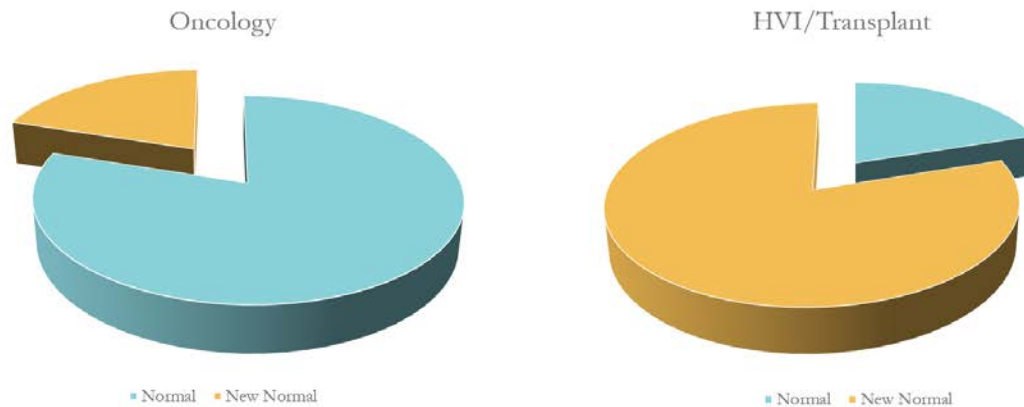


Figure 1. Unlike in oncology, transplant patients and families experienced an intense disruption to their normal lives creating the need to define a “new normal” and associated activities and spaces.

#### *Confidence, Familiarity, Passion, and Play*

Through collaborative-coding of 100+ page ethnographic transcripts per each interview, four clear themes emerged among all eight patient/family participants. There was a shared experience of loss of their sense of purpose, characterized by the loss of one, or a combination of the following:

1. Loss of **Confidence**: Navigation of a complex healthcare structure, during a traumatic disruption, created a large loss of trust and firm belief in oneself. This applied to patient and equally in family care-giver due increase responsibility for their loved one's care.
2. Loss of **Passion**: Limited physical and bodily functions often diminish patients' ability to engage in their profession or hobbies of passion. Patients expressed that losing their job was equivalent to losing their passion.
3. Loss of the **Familiarity**: Patients and families dealing with health issue(s) may experience disruptions in familiar individual / family dynamics, routines, and roles.
4. Loss of **Play**: Due to changes in priorities, play (e.g., hunting, baseball, cooking, playing games together) is often among the first activities that patients and families sacrifice. However, still value time to connect, together, to celebrate, learn, and laugh.

## DESIGN SOLUTIONS

Designing through the lens of confidence, familiarity, passion, and play provided a new approach in healthcare design framed by themed values through patient/family agency, not healthcare structure and systems, e.g., waiting, in-patient room, check-in, and others.

Consequently, rebuilding patients' and families' agency will be the result of:

1. Rebuilding Confidence by providing opportunities to stretch patient/family education to preparing for new normal.

- Example: Partnerships with museums and humanities to incorporate experiential learning & gamification, hands-on immersive learning through home/kitchen simulation for caregiver to practice at-home care, creating at home monitoring and real-time telecare, when needed,
2. Rebuilding Passion by providing opportunities for patients to practice a modified version of the original passion.  
Example: Spaces and programs where patients or former patients can provide coaching and share experiences
  3. Rebuilding the Familiar by providing experiences that maintain a sense of continuity with past experiences of normal *and supporting the new normal*  
Example: Potential for hosting family celebrations such as birthdays, sitting by a fire to read a book, going out to eat.  
Example: Immersive/simulation education experiences for patients/families such as demonstration kitchens, nutrition education, and grocery shopping, LVAD care simulation, prescription systems.
  4. Rebuilding Play by allowing for family members' creative engagement in playful activities.  
Example: Spaces that accommodate playing musical instruments, engaging in art-making, observing or participating in festivals/community outdoor programming.

#### *Characteristics of Desired Amenities/Service/Spaces*

Images that resonated with participants included spaces that:

- Provide respite from the isolation of inpatient rooms
  - “I wanted to be close but needed a change of scenery. Time for me without feeling guilty”
- Reflect normal life activities (e.g., coffee shop, hair salon)
  - “If I can’t feel normal, I want to try and look normal!”
- Integrate with the community
  - “Just being around people “living” is refreshing. And [I] want to learn about the city and people.”
- Offer a range of *affordable* food choices (i.e., healthy and not so healthy)
  - “At times, I just want a burger!”
- Engage with opportunities for creativity, learning, socializing, and play
  - “We would bring in a guitar to the room and sing. I also bought a bunch of paints to distract us in the room.”

Participants were **not** interested in:

- Franchised spaces but instead wanted to see the unique characteristics of Pittsburgh reflected in the environment
- Public respite spaces (e.g., massage chairs in open areas)
- Large-scale gyms shared by staff and patients (preferred boutique gym concept)

- Large, extensive shopping areas (preferred smaller, easy to access shopping spaces offering “essentials” (e.g., warm clothing) and special gifts

## IMPACTS OF RESEARCH

The major impact of the research resulted in a shift of perspective for the healthcare institution when thinking about patient and family/caregiver needs; *life happens when there is a healthcare disruptor* vs. *a healthcare disruptor happening to life*. This can be observed through three actions of the client.

1. Design solutions resulting from the research included a significant allocation of square footage to support normalcy and new normal through family-centric needs in solving for loss of confidence, play, familiarity, and passion
  - a. Design space to include experiential learning for family caregiver education, well-being & exercise for family support, and family connection rooms. In addition, connection to community on first floor and opportunity for placemaking in/around campus to intersect community, family, patient (if approved), and staff/provider can connect through “life”.
2. Creation of a new patient /family experience committee for oncology and redesign of HVI / Transplant Patient/ Family patient advisory committees (PAC’s) of input and discussion topics. Instead of what do you need while you’re waiting, or checking-in, there is discussion around “confidence”, “empowerment”, “play”, “familiarity”.
3. Analysis of experience within the institution’s metrics and incorporation within patient satisfaction scores. In addition, the potential for a family-only survey to understand and create new systems, places, services, and products to support family-centric care, holistically.

Because the physical space is not yet fully constructed and in-use, it is not possible to show impacts on the motivating problem. Thus, specific impact on each action, currently, is unmeasurable. However, impact from the research and process has changed the institution’s thinking about patient and family/caregiver needs and experience through newly formed empathic lens.

## CONCLUSION

This study’s conclusions can be defined as two main types of normative and intermediate. The normative conclusions highlight the benefits of iterating through quantitative to qualitative data and methods and leading the client through constructive cycles of experimentation. As mentioned earlier in the paper, ethnographic tools and methods in this study evolved as a result of a negotiation with the client institution. During the research design phase, the research team detailed the ethnographic interviews to be conducted at the patient/family’s home or place of stay. The client institution, however, did not support the research proposal, due to adherence to standard practices to maintain

control and safety of sensitive patient/family subjects. Acknowledging the value of ethnographic and participatory action research for assessing patient/family agency, the research team first worked with the client institution to establish the merit of ethnographic fieldwork and then agreed to meet the client “where they were at”. They did so by strategically using the results from the journey mapping exercise as a justification for conducting and lens for framing the in-depth ethnographic fieldwork. As a result, ethnographic interviews were conducted at the patient/family’s place of stay while patient/family focus groups were conducted at the hospital.

Intermediate conclusions included the discovery and definition of lack of agency in a way that was sufficient to persuade the client to commit to redesigning the family/caregiver experience as manifested in the design of the physical space as well as its accompanying protocols. Design decisions were made for patients and families to regain their agency by rebuilding their diminished confidence, often lost passion, familiar rituals in different ways, and creative ways of incorporating play in their lives.

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## Educating the Educators

### An Entire Franchise Preschool System Embraces Ethnographic Insights to Improve Brand Experience and Drive Growth

MEG KINNEY, *Bad Babysitter*

HAL PHILLIPS, *Bad Babysitter*

*This case study demonstrates the radius of influence that ethnographic insight can have throughout an organization as well as how it can be tied to business outcomes. This case also represents the power of video ethnography as a robust and enduring data set that provides a visceral, contextual, human record capable of aligning and galvanizing cross functional teams. At the cusp of aggressive expansion, Primrose Schools needed to address cascading business issues: low brand awareness relative to key competitors in new markets, brand engagement (vis a vis online content), and disappointing conversion rates for Parent enrollment. The first half of the case describes the design and key findings from our Parent Enrollment Study. Early education in present day America is contextualized against a backdrop of new parenting philosophies, socio-cultural relationships with smartphones and social media, and wage stagnation. The second half of the case illuminates how broadly the ethnography-inspired insights were embraced, orchestrated, and manifested across the entire organization and their strategic partners to drive results. In the end, this is a story of the measurable business impact that is possible when ethnographic insights are socialized and operationalized at scale, in large part due to skilled video analysis and editing that ingrained a realistic depiction of today's Parents in the hearts and minds of everyone at Primrose Schools.*

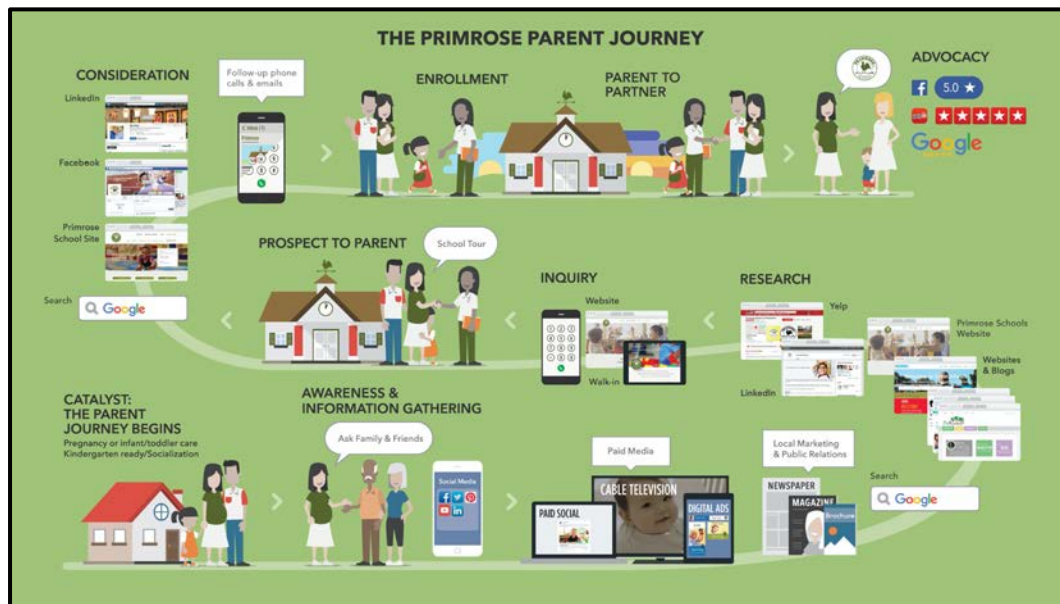
#### BUSINESS CONTEXT

Founded in 1983, Primrose Schools is a nationally recognized, premium-priced leader in early childcare and education consisting of over 400 franchised schools across the U.S. and over 11,500 employees (the majority of which are preschool Teachers). Primrose enrolls children from 6 weeks to age 5; the national average for tuition is around \$250 per week, per child. The company is on pace to become a billion-dollar enterprise by the end of 2019.<sup>1</sup>

At the cusp of aggressive expansion, Primrose needed to address cascading business issues: low brand awareness relative to competitors in new markets, brand engagement (vis a vis online content), and disappointing conversion rates for Parent enrollment. “Balanced Learning” is their proprietary curriculum; or theoretically, what makes Primrose worth paying more for. However, metrics (brand KPIs) suggested that it was an underperforming asset in driving brand equity and differentiation.

The researchers were initially engaged to address the disappointing conversion rates – the point at which an interested Parent prospect enrolls their child. Primrose already had a well-defined “Parent Enrollment Journey Map” and uses sophisticated programmatic media tools to serve content, drive online engagement, and evaluate behavior in order to move prospects toward scheduling a school tour, where the ‘sale’ is closed. Here is an example of just how highly developed the data analytics piece of the Journey Map is: If mom is upstairs researching preschool ratings and reviews on her iPad and Dad is downstairs checking football scores on his phone with the TV on, Primrose knows this and will push them both unique versions of some awareness-building content.

This means that every digital ‘touch point’ on the Enrollment Journey is monitored and optimized – from search terms, to site visits, to downloads, to mapping, to comments on social media.



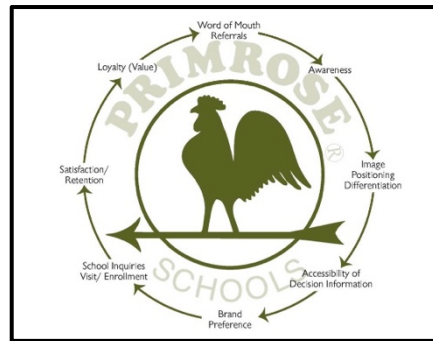
Despite the predictive model, they were not enrolling the anticipated number of Parents upon completing the school tour - the ‘point of sale’. Why was enrollment falling below what the model projected? What was the disconnect between Parent prospect expectations and the actual firsthand experience with the brand?

## CULTURAL CONTEXT

Today’s new Parents, generally described as between the ages of 25 and 45, happen to be the most educated cohort ever in the U.S. They also happen to be employed in an era of flat wages, more hours at work, and school debt.<sup>2</sup> For those families who have prioritized education, and want the structured child care environment of a “school” vs in-home, they make some pretty big sacrifices to afford Primrose-level care.

This cohort is at the forefront of parenting in the so-called ‘attention economy’ -- an age of decreased attention spans, increased stress, and demand for personalization.<sup>3</sup> Additionally, these young Parents are raising children in an Internet-first world. All of this impacts the way today’s new Parents form opinions, make decisions, and communicate.

The importance of early education has been in the zeitgeist now for a while – policymakers, business leaders, parents, and the public are generally in agreement with regard to how critical it is to invest in and prepare young children. But prepare them for what? Given the speed and complexity of the world today, it’s hard to imagine what the economy and society will need in 2035 – about the time a preschooler today will enter the workforce.



There is high demand and a competitive market for quality early education. One of the most valuable assets a school brand can have is the Teachers who deliver the curriculum. Happy thriving children are associated with good Teachers and that drives a virtuous cycle of word of mouth and brand equity. It bears mentioning that Teachers are also contending with these cultural factors too, not only as professionals, but in many cases, as young parents themselves.

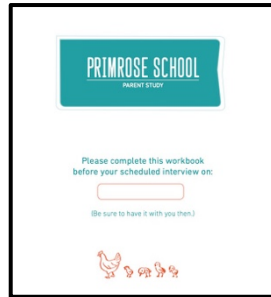
## UNDERSTANDING TODAY'S PARENTS: RESEARCH METHODOLOGY

Primrose recognized that while their schools enjoyed top ratings and positive reviews, the brand needed to more deeply understand the needs of this new cohort of Parents in order to address conversion and position itself as the more culturally relevant leader. Franchise Owners mostly came from another parenting era (and economic life stage). What seemed to be missing at Primrose was a dialogue around what today's young Parents value in child care versus parents raising children in the pre-digital/pre-mobile technology/pre-automation world. This also imparted a need to mindfully design the research methodology to accommodate for the particular stresses and distractions of this new Parent cohort.



The researchers began by conducting an audit of existing primary research to date and proprietary information. They also looked at data optimization metrics from the Parent Enrollment Journey in order to identify gaps in understanding about what motivates the new Parent enrollment decision-making. Applying an ethnographic approach, they recommended a study that could humanize and contextualize the hard data captured along the Journey. The researchers recruited Primrose Parents who had recently enrolled, Parents who were

‘shopping’ schools, and Parents who chose elsewhere. The design allowed for multiple and varied engagements that created opportunities for the Parent participants to think privately, make notes, tell stories, have fun, and embellish topics of particular importance to them.



**Recruiting:** The researchers intentionally conducted the recruiting themselves so that they could begin collecting data upon the first interaction with a Parent prospect. This also gets participants comfortable with the idea of a camera early on. Screening and scheduling took place over a series of text messages, phone calls, and emails. The research was conducted in two markets and the sample consisted of: 10 families across five different schools, a mix of infants and toddlers in the home, HHI \$50k+ annually, average Parent age of 33.

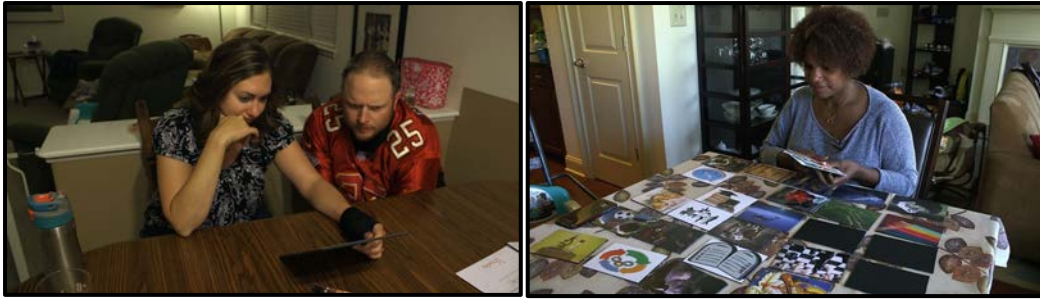
**Workbooks:** Prior to the researchers’ arrival, Parents were shipped workbooks to complete individually, in their own time. The workbooks were designed with thought-provoking exercises that would take approximately 25 minutes to complete. The workbooks were referenced during the in-person interviews.

**Sharing meals, hanging out, and riding along to drop-off and pick-up at preschool:** The research was specifically designed to include opportunities to spend time with the families going about daily routines (like meals), spending time in the children’s’ play areas to learn about unstructured time, and accompanying Parents in the car during the transitions between the School and home. These interactions were either videotaped or photographed.



**In-home and At-school interviews with Parents:** The research also included a more structured in-depth home interview which was videotaped. Because understanding Parents’ awareness, interpretation, and comprehension of the Balanced Learning curriculum was so important, stimulus was integrated into the discussion. Parents were also presented with a

sample of the Balanced Learning graphic (which is prominently displayed at the School) to get a quick read/reaction. The researchers designed an image sort to elicit projections of what Parents would like to imagine that something called ‘Balanced Learning’ meant.



**School Tours/Mystery Shopping:** For the few Parents who were still ‘shopping’ a preschool, the researchers accompanied them (under a ruse as relatives) as they toured a Primrose School. This created an opportunity to videotape the Parents’ immediate reaction once everyone got back into the car.

**School Observation:** Finally, throughout the fieldwork, the researchers spent time talking to staff and observing daily routines in five different Primrose locations. This was not videotaped.

## INITIAL ASSIGNMENT: IMPROVE CONVERSION

New Parents are naturally overwhelmed; this does not change from one generation to the next. However, from the very first recruiting calls through the fieldwork, the researchers quickly noted a very contemporary version of what ‘overwhelmed’ looks like today: long commutes to work, demanding schedules, constant interruptions, pressure to get on waiting lists pre-birth, shortened or unpaid maternity/paternity leave, and logistical hurdles.

A refrain heard over and over was “my child is going to spend more waking hours with that Teacher than with me” and “by the time we get home, all we have time for is feed, bath, bed”. This time calculation becomes a lens through which Schools are evaluated: *who are these people and what does ten hours a day look like at the School? Will they love my child and be building him/her up?*

The researchers learned that early in the Enrollment Journey things like safety, security, and cleanliness were important topics researched online and that pedagogy was explored on the website. Parents exhaustively sought input on all of these things from other parents in the community and on social media. Media metrics (e.g. SEO, Google Analytics) bore this out and subsequently the interpretation of the data was that these things were key topics to cover in the School tour.

With regard to the Balanced Learning curriculum, Primrose assumed since prospects engaged with white papers and academic content that Primrose posted online, that Parents understood it.

An early, important realization that the researchers had was that up until the tour, all of the ‘touch points’ in the Parent Enrollment Journey were mediated experiences; meaning,

Parents were relying on the opinions and perspectives of others. Parents have no *gut instincts* to operate from leading up to the tour. Gut instincts come from being able to use your senses. The tour is usually their first sensory input and face to face interaction. Cues received on the tour inform the necessary gut feelings to believe that Primrose is a safe and loving learning environment where their child will thrive.

In conversation, Parents consistently indicated that the make-or-break enrollment decision came down to a feeling or an observation made on the tour. A few examples:

- A School Director giving a tour in heels and dangling earrings. “She doesn’t look like someone prepared to step in if a classroom needs extra help.”
- Teachers who don’t make eye contact or interact with the Parent prospect. “We don’t need to be best friends but you’re going to be raising my child with me so we should at least have a chance to talk.”
- Feeling judged by the School Owner. “I think she gave a lackadaisical tour because she saw this (gestures to husband’s long ponytail) and thought we couldn’t afford it.”
- Balanced Learning was an artifact “from Corporate”. “I remember seeing something in the brochure about it but the Director who gave me the tour never talked about it.”

Parents needed something very specific from the tour in order to commit – reassurance that the humans at Primrose were decent people, a visualization of how Balanced Learning plays out during a day, a sensed collaboration in raising their child. They did not want to be led by a docent pointing out evacuation routes and cleaning procedures and educational toys. They wanted eye contact and conversation with Teachers. They wanted a demonstration of how a Teacher can use a puppet to teach values. They wanted to smell lunch, hear songs, and touch nap blankets.

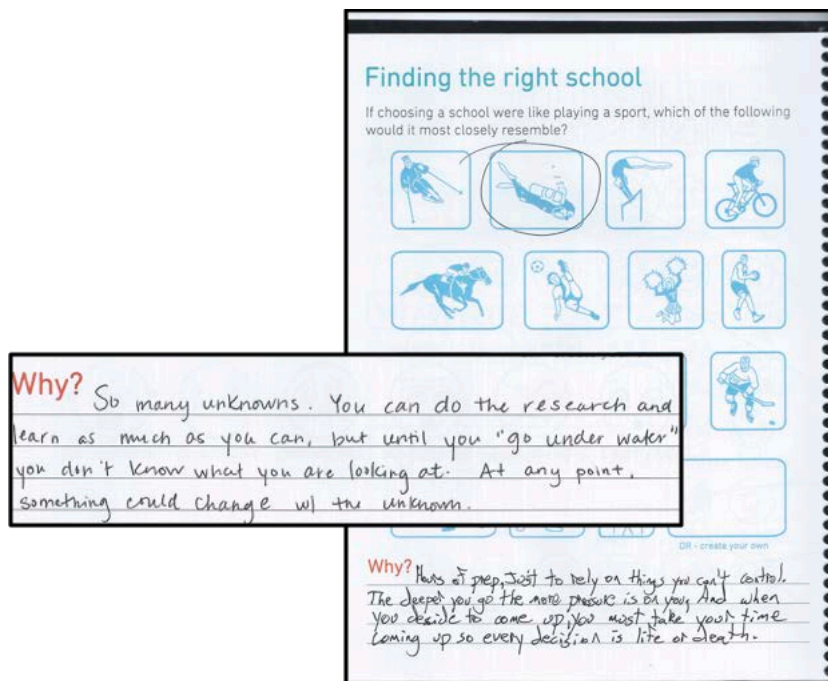
The researchers observed Parents tear up, get dizzy, and feel queasy with guilt while School directors faithfully lead them through a scripted tour. Parents were projecting into the emotions of letting go while pragmatic words washed over them. One Parent described the feeling as “like jumping out of an airplane”. Another described it like scuba diving where “The deeper you go, the more pressure is on you. You must take your time coming up so every decision is life or death”.

## **OPPORTUNITY REVEALED: RE-CALIBRATING THE BRAND EXPERIENCE**

These larger realizations that Parents worry most about the length of time their children are in the hands of strangers, and their need *to feel in their gut* that they are making the right education decision, opened Primrose up to an entire examination of how the brand could be more empathetic beyond simply reimagining the school tour. Because an ethnographic approach was used and interactions were captured on video, there was a vast amounts of rich, organically generated data.

Significant themes and insights that the research brought to the forefront:





Excerpts from the workbook that Parents completed prior to the in-home visit.

## A New Peer-to-Peer Generation of Parents

- Today's Parents want the School to treat them like peers. The Primrose brand struck an authoritative 'one to many' tone that was off-putting. Parents today are more accepting that there are multiple approaches to learning (and parenting), have access to the same information as anyone else, and prefer language that doesn't feel judgmental.
- Today's Parents see conflicting 'expert' information all of the time (e.g. co-sleeping with your child is good/bad, your child should sleep on its back/stomach, and so on). Just because Primrose posted it, doesn't make it true.

## The Enrollment Decision is More Highly Involved Than the Journey Map Suggests

- While Primrose understood that the Parent Enrollment Journey wasn't experienced in a linear fashion, they approached its creation from a media perspective – digital touch points that could be measured and optimized. As a result, this study identified important emotional inflections in 'real life' that deserved to be represented on the Journey Map in order to truly understand Parent motivations.

- The researchers identified what they called “the decisions before the decisions”, essentially the conversations (and arguments!) that Parents have even before they begin online research and asking friends and family. These were discussions about how much money preschool was worth (*should it be more than a mortgage payment each month?*), whose job was more flexible for pick-up/drop-off duties, and what their own childhood memories of preschool included.
- A nuanced implication of this more emotional, offline, missing piece of the Journey was understanding just how exhausted Parents are on the topic by the time they actually visit the School.

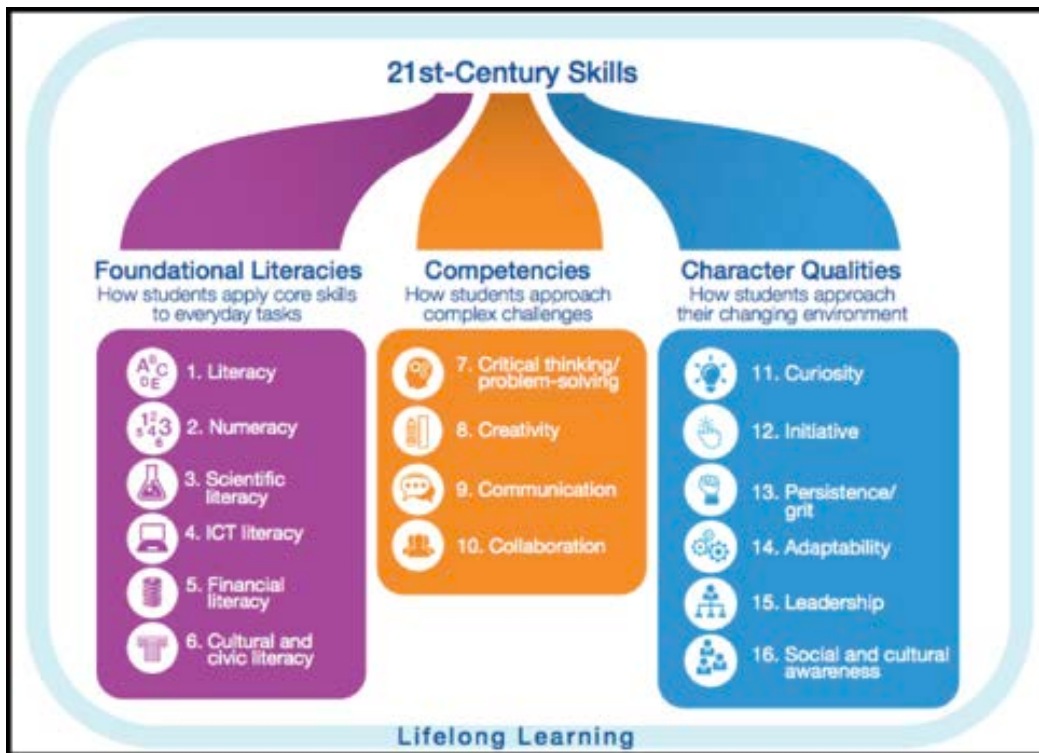
### **A New Era of Parenting Styles**

- School Owners were used to previous generations of Parents who valued specific learning milestones and achievements as signs of preparation (e.g. learning to read before Kindergarten). Today’s Parents spoke of wanting curiosity nurtured, self-expression, and to instill a love of learning. “When my child says ‘look mommy, it’s raining outside’, I want him in that moment of wonder about rain. I don’t need him spelling r-a-i-n.”
- Culturally, there is a shift away from the reassured child (e.g. participation trophies) toward the resilient child.<sup>4</sup> Being adaptive is a 21<sup>st</sup> century skill.

### **A new way of determining the value of their tuition investment**

- Young Parents put as much emphasis on social skills and character building as they do on literacies and competencies at this age. When asked to imagine the most valued traits in 2035, Parents said things like tolerance, kind-heartedness, and work ethic. Parents were seeking social preparation as much as academic preparation. They described a world where their child will have to get along with “other”...be it human or machine.
- Balanced Learning was something vaguely recalled but never really internalized. As presented, it was too academic; jargon got in the way of meaning – so much so that School Directors weren’t even able to be comfortably fluent about key points of difference in the curriculum.
- Parents come to the tour with a grasp of early education concepts but cannot locate where Balanced Learning sits among them (unlike, say, Montessori). This inhibited word-of-mouth about the very cornerstone of the brand and its value proposition.





Character Qualities emerge as a critical pillar of education.<sup>5</sup> Jobs that require social skills grew 24% between 1980 and 2012.<sup>6</sup> Graphic © World Economic Forum, used with permission.

## A New Kind of Relationship

-It's not just enrolling in child care; it's joining a community. Parents are looking for a preschool with shared values, not just credentials. Primrose is a culture unto itself.

## ETHNOGRAPHIC INSIGHT: SCALED AND OPERATIONALIZED

The research was originally commissioned by the Chief Marketing Officer at the behest of his creative marketing agency who was at a loss about how to change content and messaging relative to improving conversion. Upon presenting the full scope of our findings through theme-based video vignettes, in conjunction with relevant quantitative Journey metrics, the CMO felt the immediacy and potency of the work. A workshop was scheduled to more broadly share the insights and their applications to cross-functional leaders: School operations, professional development/training, curriculum development, corporate communications, and service design.

The research video figuratively put the Parent in the room. Existing strategies were evaluated through this fresh, contemporary lens of today's new Parent. Over the course of

six months, every discipline implemented a set of core principles to evaluate and evolve their executions. Below are just a few examples of the application.

**Prior to doing ethnography...**

**Evolution as a result of ethnography...**

<b>Brand tagline:</b> “America’s leader in Early Education and Childcare”	“We believe that who children become is as important as what they know”
<b>Content:</b> Statistic-heavy, academic research and an authoritative voice	Balancing gravitas with example-rich, practical everyday insight with an approachable voice (e.g. moving from “studies show” to “we believe”)
<b>Advertising:</b> focused on literacies and competencies	Put equal emphasis on character building
<b>Balanced Learning:</b> communication focused on <i>what</i> children learn	Communication and demonstration of <i>how</i> children learn
Balanced Learning “philosophy”	Balanced Learning “approach”
<b>Balanced Learning:</b> discussed on the website and in the brochure; a graphic in every School	Show me, don’t tell me: Simplified language, re-designed graphic and relatable examples on the website; demonstration-based examples throughout the tour; “Balanced Learning in Action” communication platform integrated in advertising and delivered as photos and texts sent to Parents
<b>Tour:</b> a scripted monologue focused on pragmatic features of the School.	Tour as a dialogue. Active listening. Deliberate pauses for Parent emotions.
<b>Tour:</b> inconsistent first impressions.	Focus on first 6 feet, first 60 seconds
<b>Journey Map:</b> measured media-oriented	Journey Map was revised to include “decisions before the decision”, emotional arc, and key offline conversations

As the researchers led cross-functional teams through workshops of ethnographic insights, the “Manifestation of Culture”<sup>7</sup> model became an incredibly simple and meaningful reference. Primrose leaders were able to see the potential impact of applying the findings and the interdependence of their respective implementations. It helped to orchestrate all of their brand equities and proprietary assets into a cohesive, ownable, defendable and memorable brand experience. The incredible curriculum and value proposition of Primrose Schools was fortified. Importantly, it became easier to talk about.



“The Manifestation of Culture” model. Photos from the study and © Primrose Schools, used with permission.



Primrose codified their values into their tagline “We believe that who children become is as important as what they know”. Everyday greetings, songs, and ‘first day of school’ backpacks became seen as rituals. Teachers, who Parents needed to interact with in order to make the enrollment decision, are our Heroes. Proprietary character-building assets like the “Erwin the Dog” puppet, who teaches friendship, became symbols. School owners then understood that doing things like printing up stickers of the puppets were meaningful practices that bind everyone to the culture. Enrollment was taken out of the context of being a transaction, and placed in a context of starting a relationship.

After Primrose integrated the ethnographic findings into their larger product and marketing strategies, they didn’t stop! This research became the keynote address at the Primrose annual Franchisee Meeting where 600 School owners attentively listened to video of today’s new Parents. To be fair, Primrose has always been sensitive to the unique needs of families. However, this research grounded that understanding in more contemporary terms in order to address the cultural tension in the preschool decision today: *how can I know what skills my child should learn when the future is more unpredictable than ever?*

Lastly, Primrose Franchisees (aka School owners) asked to take the learning one step further and share it with their School Directors and Teachers. The research footage was converted into a system-wide online “Learning Library” and in-service training day that over 10,500 employees participated in.

## **Teamwork Makes the Dream Work**

When ethnographic insight is socialized and operationalized at this scale, it can inform decisions and actions at all levels of stakeholders throughout an organization. Consequently, it’s not a stretch to attribute results to ethnography. The clients at Primrose proudly credit this work as the catalyst for a brand transformation that yielded the following results, benchmarking 2017 performance against 2016 KPIs:

- 4% growth in Parent enrollment
- Ranked 1st in unaided awareness (31%) among competitors (Primrose was previously ranked 4<sup>th</sup>)
- 18% increase in inquiries
- 24% increase in engagement (social media metrics) including the highest number of followers and engagement on Facebook vs any other child care company (surpassing KinderCare which is 3x larger than Primrose)

Ethnography has long sought its rightful place in business as a strategic practice and business tool. While ethnography is most likely funded by a singular business unit or discipline in an enterprise, its impact does not have to be limited to its ‘owner’. These researchers believe that video should be seen as much more than a powerful data capture and presentation tool. When footage is treated like a data set (that can continuously be mined) and analysis and editing are intertwined, then video-based ethnography has unlimited applications that in turn help prioritize ethnography as an investment in the business as a whole.

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## Papers Session

# Automating Ethnography

Curator: Sakari Tamminen (Gemic)

This session explores automation of ethnography through three case studies. What do data-driven systems do to human agency and work practices? How could we conceptualize where AI can be a helpful tool for people? In what way does automation of data collection and processing help ethnography, and what are the watch outs here?

The collection of papers is contextualized within the broader question of human agency in different data-driven settings. The authors explore how does data-driven decision making emerge, where does the value of automation lie, and how do new ways of capturing and using data change the role of anthropologists, ethnographers, designers and consultants in a data saturated, AI-driven world.

## Designing Good Jobs

### Participatory Ethnography and Prototyping in Service-Oriented Work Ecosystems

MARTA CUCIUREAN-ZAPAN, IDEO and DePaul University  
VICTORIA HAMMEL, IDEO

*Three service design projects, in hospitality, finance, and health care, highlight how to design for agency in the workplace, including the implementation of automated and data-driven tools. Inspired by Tacchi, Slater, and Hearn's work on ethnographic action research, Amartya Sen's capabilities approach, and Gibson's affordances theory, this paper examines work as an ecosystem, in which workers' motivations, values, and ability to achieve what is important to them should be a continual input into how structures and tools are designed. In order to design for agency, teams must shape access to information in order to support workers' autonomy. Second, project outcomes should reflect the emotions and values which create a sense of progress and purpose. Third, tools, technologies, culture, and incentives within the work ecosystem should be aligned with workers' goals. Finally, workers must feel safe and protected from censure when they participate in co-creating their own roles.*

## INTRODUCTION

Service design challenges underscore the imperative for human agency alongside systems which automate, assist, augment, or otherwise interact with workers. Responding to this need is crucial in order to support workers' well-being and sense of purpose in the largest sector of the US economy (U.S. Bureau of Economic Analysis 2018). Definitions of agency in the work of Pierre Bourdieu, Anthony Giddens, and others aim to capture the capacity for change and creativity which people exercise on social structures (Rapport and Overing 2000: 8). Measures linked to high job satisfaction, like autonomy and creativity, mirror anthropological and philosophical definitions of agency (Pink 2009, Heath and Heath 2017). Therefore, in order to understand and design agency into work environments, an ethnographic understanding of the sources of meaning for workers is essential, as is their participation in ethnographic and prototyping methods.

Ethnography has the capacity to influence the design of good jobs. As businesses increasingly look to automation to create value and competitive advantage, human centered design is key to shaping its impact on service roles. Pairing ethnographic insights with worker participation is an essential part of shaping this future. This includes understanding how automation could support workers to enhance the agency they experience in their daily tasks, rather than eliminating work that provides meaning and value to them.

This paper draws on three original service design projects which combine ethnography and live prototyping. Design outcomes include patient scheduling software and call center dashboards which track and visualize customer past behavior and preferences, scripts of service interactions, and incentive structures. These projects exemplify how to build trust with workers and bring them along in the design process, how to approach the complex systemic challenges that underlie work to design better ecosystems, and how to observe, experience and understand what's important to different people in the work environment.

The three projects highlight how to design for agency in the work ecosystem. First, document and design the access and presentation of information and data points in order to support workers' expertise and autonomy in how they interact with others. Second, consider the emotions and values which create a sense of progress and purpose for workers, and make sure those are reflected in project outcomes. Third, harmonize the goals of workers within the service ecosystem by aligning tools, technologies, culture, and incentive structures. Work is an ecosystem in which no worker or tool functions in isolation. Finally, make it welcome and safe for workers to continuously engage and co-create their own jobs. If workers fear censure in making themselves vulnerable and sharing questions and feedback, this has a negative impact on agency.

## **BACKGROUND AND METHODOLOGY OF PROJECTS**

### **Creating a Hybrid Customer Service and Sales Role with a Mortgage Provider**

This project combined ethnographic methods and live prototyping in order to design a hybrid customer service and sales role to support long-term relationships with homeowners. The first half of the project included ethnographic methods, participatory exercises, and observation of homeowners and workers in one of the company's call centers. The second half of the project focused on developing opportunities and supporting concepts, and live prototyping ideas in the call center, including recruiting materials like posters, a space for agents to relax and share ideas, a set of cards with conversational prompts, a voice analytics tool that captured and visualized agents' language on calls back to them, and a customer 360 dashboard. Prototyping invited employees to co-design the new role and supporting ecosystem of tools, spaces, and incentives. The prototypes tackled the disconnect between homeowners and their mortgage provider, with the goal of building a more active and lasting relationship between the company and the homeowner through workers' engagement.

Agency in the mortgage call center meant several things for workers, including 1) a sense of progress from growth opportunities, 2) connecting to a sense of purpose through a personal and unscripted interaction with the customer, 3) feeling safe to share issues or learning areas with management and each other. The first area required a shift for design from competition-oriented incentives to one that incentivized collaboration on behalf of customers. The second meant that a rigid structure for sales or calls wasn't going to work for this new role, and new solutions needed to be found. Anything too scripted or structured was uncomfortable for these agents: they described themselves as needing to be able to "go with the flow" in order to have a successful interaction with the customer. Going beyond scripting and connecting to higher level motivations was essential to a designing a holistic work ecosystem which supported employee agency. For example, one agent's favorite part of the job was being able to help elderly customers with their financial challenges. Finally, learning and development was key to helping agents feel like they were improving and finding a sense of purpose in their work, but this primarily took place among people sitting next to each other. In order to circulate learnings more widely, the ecosystem needed to make it comfortable for agents to share stories about customer interactions.



## **Harmonizing a Cruise Company Customer and Call Center Experience**

The goal of this project was to eliminate the frustrating impact of back-end systems on customers and workers. Over the course of two projects, teams interviewed and observed stakeholders, customers, and agents in multiple contexts, including at home, in the call centers, and during a cruise (Sampson 2018). The team found that booking was repetitive for customers. At the same time, agents felt held back from delivering the customer experience they wanted by the limitations of their tools. For example, customers often had to start their request over again as they were transferred from agent to agent. The agents' different roles were opaque and irrelevant to customers, but nonetheless they experienced the friction of the backend system as they tried to learn more about or book their vacation. In later stages, this led the team to prototyping tools such as a dashboard that aggregated several sources of information about the customer, including previous cruises and calls. Organizational and environmental design also played a role. Team members who previously sat in different places were co-located and new incentive structures were designed, aimed at rewarding collaboration and information sharing on the customer's behalf.

The final designs and recommendations supported the ethnographic understanding of agency in the cruise call center context. As in the mortgage company call center, agents wanted a degree of autonomy while ensuring that changes to the work ecosystem wouldn't negatively impact their livelihood. However, delivering the customer experience was industry specific - rather than financial expertise, agents were expected to project hospitality and fun, without being overly casual. For these workers, agency meant 1) having the authority to act on behalf of the customer, 2) confidently performing and projecting their expertise, and 3) feeling in the know and in control of the latest organizational and product shifts that could affect their job performance and evaluation. Agents wanted to do what was best for guests, but silos and rules took the relationship out of their control. Agents shared that, "It feels like I have to fight for myself and my guest." Second, tools and backend systems which agents couldn't rely on negatively impacted their desire to confidently perform their jobs for the customer and for each other. Agents described that with current tools, "It feels like I'm going in blind." One agent described their analog system: "I write all my bookings here [in my notebook]. I've already had to get three new computers, so I'm scared my stuff is going to delete." Third, agents believed in their company and its offering, but felt like they were always playing catch up with rapidly changing information. For example, they had to use the website to look up the latest offers. Others described that, "It feels impossible to keep up." Since offers affect incentive structures, the negative impact on agency increases, since agents not only feel they can't perform their jobs the way they want to, they may also lose control over a part of their livelihood. Recommendations targeted systems and structures which would allow agents to feel more in control of how they were able to help customers and navigate incentive structures.

## **Refreshing a Hospital Patient Appointment Scheduling System**

Hospitals are complex environments in which regulations govern processes, the pressure of living up to one's responsibilities is essential, and decisions can determine life or death. Based in a pediatric hospital, this project aimed to understand, evaluate and re-design the patient experience in anticipation of the construction of a new building. A primary goal was

to avoid replicating “broken” processes, so insights and concepts emerging from research and prototyping were targeted to inform the new building architecturally, systematically, and operationally. The team explored the patient experience, operating systems, and clinic workflow for what could be duplicated and what needed to be rethought. While the focus was the patient experience, understanding staff members’ responsibilities and the complexity of operations was key to the project’s success. The team interviewed staff members in multiple roles and departments, documenting their daily tasks, tools, challenges and needs to understand how these fit into the ecosystem of delivering care.

Parallel research with care providers and patient families uncovered a disconnect. Families seek visibility into upcoming care, but because the effect of treatment on patients’ well-being is uncertain, adjustments must be made over time. Currently 100% of appointments are rescheduled. Families expect staff to be up to date on the patient’s diagnosis, progress, vitals and medication, but the lack of information transparency between departments forces parents into the role of mediator, communicating vital information about their child in terms with which they are not familiar. The hospital and staff are passionate about providing the best care, but siloed operating systems that add additional steps to the busy routine make it difficult to do so. The inefficiency of analyzing information creates a tense emotional interaction between the staff and their tools. However, staff members rely heavily on these systems and expressed a strong desire for improvement. Instead of having to do the time-consuming gathering of information themselves, they wanted smart solutions which could provide the information they need, when they need it, and in their preferred manner. For workers in the hospital setting, job satisfaction and agency means focusing more on patients and less on tools, making time for what they believe truly matters.

## **LITERATURE REVIEW**

Ethnography is key to a design process that enables worker agency through their participation. This argument is situated in literature that defines agency in social science theory, as well as in the work context through analogous measures of autonomy and well-being. In service environments such as call centers and clinics, automation, rules, and scripting have been shown to have the potential for negative impact on purpose, emotion, and workers’ alienation from the products (or services) of their labor. The history of emotional labor, the expectation to regulate emotions and interactions on behalf of organizational roles, heightens the need to examine how automated systems, scripts, and other tools might work against a sense of agency and autonomy at work. This paper draws on relational and contextual perspectives on human agency in order to better understand and explore how ethnography and prototyping on behalf of, and ideally with the participation of workers, can be used to design for workplaces in which people are more likely to achieve values relevant to them. Anthropology, human rights, and ecological psychology all offer inroads into this effort. Tacchi, Slater & Hearn’s work on ethnographic action research, Amartya Sen’s capabilities approach, and Gibson’s affordances theory inform the metaphor of work as an ecosystem, in which workers’ motivations, values, and ability to achieve what is important to them should be a continual input into how systems and tools are designed.

Agency as a construct accounts for creativity and change in the social structure. Within the work context, measures of purpose, well-being, and autonomy point to the potential of designing for jobs that increase workers’ sense of agency. Nigel Rapport and Joanna Overing

(2000) write that agency first emerged in anthropology in order to resolve the differences between structure and individual action, “and explore the limits on individual capacities to act independently of structural constraints,” (1). The link between structure and individual action, and how that influences worker well-being, was explored by Karl Marx, “who argued that paid employment removes the capacity to produce according to one’s own will and imagination, thereby limiting pride and satisfaction while reducing work to a means of survival no different from the productive impulse of animals” (Cited in Crowley 2012). In *Dignity at Work*, Randy Hodson describes how, “work arrangements vary in the degree to which they allow workers to self-express and to derive a sense of self-worth and self-respect from their jobs – producing measurable differences in outcomes such as autonomy, creativity, effort and pride,” (Crowley 2012: 1384-1385). Call centers in particular illustrate the potential for work environments to impinge on worker agency. In fact, “studies have shown that the combination of scripts, quality assurance rules and supervision generates stress and resistance among call-center workers,” (Callaghan & Thompson, 2002; Knights & McCabe, 1998 cited in Crowley 1386-1387). For example, in the cruise center project, call centers workers described how the redundancy in their tools was holding them back, causing frustration for everyone as customers had to repeat details on each call. As service-oriented people, the call center agents felt they could not deliver the type of interactions customers deserved. Similarly, in the mortgage services project, agents in both sales and customer service had their eye on metrics such as call time and volume. Because these measures influence how they are evaluated and paid, the goal of building customer relationships was unlikely to get the same amount of attention without making changes to incentive structures. If agency is defined as the ability for individuals to change the social structure around them, agency within service-oriented work would include employees’ capacity to influence how they perform their work to better align with their motivations and values. For example, call center workers were more able to establish satisfying interactions with customers once incentive structures and metrics were co-created.

Recent explorations into motivation and meaningful work underscore the benefits of engaged, purpose-driven workers for organizations, as well as for the intrinsic value those workers experience. In *Drive: The Surprising Truth About What Motivates Us*, Daniel Pink (2009) cites the cross-cultural link between autonomy and well-being (88). Besides the positive impact on workers, autonomy is correlated with better business results. Pink writes that in a Cornell study of 320 small businesses, “The businesses that offered autonomy grew at four times the rate of the control-oriented firms and had one-third the turnover,” (89). The mortgage industry experiences a high rate of turnover. The new role was mutually beneficial to the company as a means to retain and attract employees, and for employees as a new path for professional development. This role was co-designed to provide agent autonomy in making meaningful choices about how to engage with customers, such as time off script. In *The Power of Moments*, Chip Heath and Dan Heath explore the relationship of well-being, autonomy, and other factors that contribute to worker satisfaction. In a survey of 5,000 employers and managers, “These people with a strong sense of meaning tended to have the highest performance rankings by their bosses,” (Hansen cited in Heath and Heath 2017: 217). In the hospital project, schedulers and clinicians were highly motivated by families’ and patients’ experiences and health outcomes. The team’s task was to make sure that their tools supported staff members as caregivers, allowing them to express their passion and knowledge rather than adding steps into their busy days. Being attentive to, and designing

for, workers' individual and specific sense of purpose, motivation, and autonomy leads to individual and organizational benefits.

Emotional labor, the expectation for service workers to "align their displayed emotions with organizationally desired emotions through their choice of emotional labor strategies," further intensifies the pressures on service workers, especially in low wage, highly interactive, and gendered occupations (Hochschild 1983: 59). Emotions are becoming "tools of labor" as "paid work is shifting towards symbolic forms of production" (Forseth 2001: ix). In the hospital environment, illness and injury, intricate treatment plans, and complex appointments increase the stakes of emotional work clinicians must do. Helping patient families navigate a world they don't understand is an emotional weight carried by clinicians, but one that can be lightened by feeling prepared and well informed before seeing a patient. Call centers receive special attention in marketing, organizational studies, and service design, perhaps because this type of work is expected to deliver high quality customer service at the intersection of complex front- and back-end systems. Agents in the cruise and mortgage company call centers were evaluated by quality assurance spot checks that aimed to gauge the emotional comfort they created for callers. This was despite potentially conflicting measures like call time, which incentivized them to keep interactions short. In the literature, call center workers are at the front lines of tech-mediated late capitalism, the humans among digital and automated touchpoints like websites, apps, and platforms. For example, this includes drivers trying to reach Uber's customer service representatives to argue a fare (Rosenblat 2016) or customers returning an order with online shoe retailer Zappos (Solomon 2017). Systems intended to automate or augment, such as Uber's platform for its consumer-drivers, can inadvertently or intentionally disempower workers. These systems can also become a means of control or "algorithmic management" (Rosenblat 2016). In a case study of Uber, Rosenblat argues that "Through tools such as dynamic, algorithmic pricing and a number of other elements of the Uber application's design, Uber is empowered via information and power asymmetries to effect conditions of soft control, affective labor, and gamified patterns of worker engagement on its drivers," (2016: 3759). Because workers like nurses and call center agents are called upon to perform emotional labor, necessary to how patients and customers will perceive their experience, the three projects explored how organizational goals and worker motivations could align through designed interventions. This included incentive structures, physical spaces and feedback mechanisms for employees to reflect on and suggest changes in their roles, and employee value propositions communicated through recruiting material and job descriptions.

Involving participants like call center workers and clinicians through ethnography influences the team's ability to translate research findings into actionable design outcomes. Several approaches, including ethnographic action research, Amartya Sen's capabilities approach, and James Gibson's affordances theory, ground how worker-influenced ethnography and prototyping can lead to design that increases agency within the specific and local work context. Ethnographic action research was developed in the early 2000s based on earlier participatory methods within social science, in response to the uniformity and shortcomings of information and communication technology as a panacea to the challenges of communities in so-called developing countries. One of its originators, Jo Tacchi, describes how "The ethnographic approach combined with action research means that it builds upon notions of immersion, long term engagement, and understanding local contexts holistically," (2015: 1). Each project included sustained engagement over time between workers,

stakeholders, and the design and research team. The hospital project was part of a multi-year client relationship, building on previous knowledge of the culture and workflow to inform the specific patient scheduling challenge at hand. The cruise project was part of over a year of work, during which the team first immersed in the cruise experience, customers' vacation planning, and call centers, before designing a new customer 360 dashboard to better connect the employee and guest experience. In their work, Tacchi, Slater, and Hearn elaborate on the concept of a communicative ecology in Ethnographic Action Research (EAR), a metaphor that highlights the importance of continuous, relational research and design in a specific local context in order to understand what is really needed and should be implemented by the community members. They write, "If you are studying the ecology of a forest or desert, you do not look at one or two animals or plants in isolation... The same applies to communications and information: there are many different people, media, activities, and relationships involved," (2003: 15). Research ideally becomes a part of the culture of the organization, and the researcher becomes a "social-cultural animator," who "breath[es] life into the projects and the underlying dynamic of the communities in which they are located," (27). For example, in the mortgage project, the goals of live prototyping included learning from and engaging workers in designing their work environment and tools, in a sense, "animating" the project outcomes. The same principle was applied to the deliverables, which were spatially and experientially shared (e.g. software tools at an agent's workstation, instead of in a presentation in a conference room). Due to the multi-year relationship, clients from the hospital made access to staff, spaces, and patients a priority, so that the team could get the holistic understanding required to move design forward. Working side-by-side with staff and patient families underscored the scale at which deliverables would need to be shared, resulting in outcomes such as an installed gallery of findings.

The metaphor of a communicative or information ecology ties EAR to other work that highlights human action as central to understanding and deploying technology in the service of individual and community agency. Bonnie Nardi and Vicki O'Day argue for an informed engagement with technology in local communities, in which information ecology as a construct helps "focus attention on relationships involving tools and people and their practices." (1999: 50). Information ecologies are "A system of people, practices, values, and technologies in a particular local environment. In information ecologies, the spotlight is not on technology, but on human activities that are served by technology," (49). Even earlier in the literature, cognitive and ecological psychology developed the idea of situational and relational meaning between animals and the environment, and humans and tools. James J. Gibson developed the idea of affordance throughout his career, culminating in his last book in 1979: "The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill," (1). For example, he uses the example of a rock, and how it may serve as a "paperweight, a bookend, a hammer, or a pendulum bob," depending on the individual's abilities and goals, instead of automatically categorized into just one class of objects (7). Or a ledge, which may serve as an affordance for sitting or climbing depending on the animal or human's size, age, intention, and physical structure. Gibson's goal was to cut "across the dichotomy of subjective-objective and helps us to understand its inadequacy. [An affordance] is equally a fact of the environment and a fact of behavior. It is both physical and psychical, yet neither. An affordance points both ways, to the environment and to the observer," (3). Later practitioners and theorists like Don Norman reframed affordance in the fields of design and human computer interaction, breaking down how

interactions from stoves to mouse clicks can be supported and suggested by the object itself (Jenkins 2008: 41). An ecological perspective on the interaction between individuals, tools, and environment around them means that ethnography in the work context should be situated and respond to what is important to the workers, variability among them, and how they might be engaged in co-designing and iterating design solutions.

The ecological perspective highlights the need for all three projects to reframe the brief beyond the initial problem that catalyzed action. On the cruise project, stakeholder calls to the call center revealed a less-than-ideal experience. But in order to address this disconnect between backend systems, workers, and customers, the team needed to understand the entire vacation planning, booking, cruise and work experience, including mapping the current tools and data sources at play. This led to a design solution that incorporated a new team structure, incentives, and tools in order to help the vacation planning process reflect the fun and anticipation of a cruise. For the mortgage company, combining sales and service seemed like an opportunity to increasing revenue, but this combination of tasks alone wouldn't deliver the desired outcome. In order to engage employees, they first needed to understand what the new role was and how it could benefit their careers. By considering the work environment as an ecology, with financial and purpose-led motivations understood, the design solution included a clear value proposition expressed through communication material and redesigned workspaces, and aligned tools, metrics, and incentive structures. In the hospital project, the refresh of scheduling software was a core component of redesigning the patient experience. An ecosystem approach was necessary because issues in the scheduling system were themselves a result of the complexity of appointments and flux of treatment plans. The team couldn't design a solution without understanding the variables which went into appointment planning, as well as the variables workers themselves preferred to be automated versus under their control.

The ecological approach also resonates with Amartya Sen's idea of capability, "the opportunity to achieve valuable combinations of human functionings — what a person is able to do or be," (Sen 153). Sen's argument allows us to approach development in a nuanced and therefore potentially more effective way. For example, reaching a certain income level as a universal measure of development does not guarantee individuals the same opportunity to achieve life goals they may or may not share, like being well-nourished and achieving a sense of meaning in their lives. A unitary concept like income level, or "poverty" or "the Internet" (as Tacchi, Slater, and Hearn point out), must be contextualized in the culture and ecosystem in order to understand, "(i) whether a person is actually able to do things she would value doing, and (ii) whether she possesses the means or instruments or permissions to pursue what she would like to do" (153). Peter Evans elaborates on how capabilities allow us to reconsider how to approach development, but also "implies that choices about those allocations and growth strategies must be 'democratic,' not just in the 'thin' sense of having leadership succession determined by a regular electoral process, but in the 'thick' sense of messy and continuous involvement of the citizenry in the setting of economic priorities," (55). In other words, to understand how a capability like agency is accessible to individual workers and to what degree, research and design teams must continually engage with them in co-designing and iterating the solutions and tools that could potentially help them exercise their agency.

## LEARNINGS ABOUT CO-DESIGNING FOR AGENCY

This paper argues for ethnography and prototyping with workers in order to create ecosystems, including automated tools, which enhance rather than detract from individual agency. Since the projects focused on service work environments in North America, there is strong overlap in how workers defined and found agency at work. We focus on these intersections in our learnings about agency, but call out when the specific work context affects how agency was expressed and then designed for by the project team. Drawing on the three project examples, the following implications emerge as learnings for how to co-design for individual agency within service work ecosystems:

- Enhance worker agency by co-creating tools and systems together with workers
- Consider the emotional dynamic between worker and tool, including the potential to instill self-insight through automated tools
- Design for an ecosystem perspective, accounting for workers' individual relationships with each other, as well as tools, technologies, organizational and incentive structures

First, ethnography builds trust and generates insights in order to co-create tools and systems that align with users' goals and values. During the mortgage services project, the team conducted contextual inquiry with homeowners as well as participant observation with call center employees. At a later phase, the team live prototyped tools, including a dashboard which aggregated customer and product information. In earlier phases, the team learned that being able to make a personal connection with the customer was important to workers' sense of agency. Therefore, the team explored the tension between documentation and scripting versus openness and creativity with the dashboard and a set of customized cards. Inspired by Brian Eno's *Oblique Strategies*, the cards included prompts like: "What's the best advice you've ever gotten from someone else on your team?" and "Who is your role model? How would they handle the next call?" The goal was to introduce a generative tool to inspire the agent to infuse the scripted conversation with their own reflections and words, while making the role more engaging. Designing for engagement allowed agents to influence how they interacted with customers, without burdening them with additional oversight. As evidenced by the excitement these prompts generated, this also recognized and supported agents' expertise and passion to engage with customers in a professional but personal way.



Figure 1. Cards to prompt off script conversations with customers

On the cruise project, ethnography identified the negative impact current systems had on agency, because these failed to capture or scattered customer information among multiple programs. One agent described, “I feel held back by my tools.” This was a detriment to agency in two ways: it hurt agents’ desire to confidently project their expertise and their authority to act on behalf of the customer. Customers experienced this impact as well. They reflected that having to constantly repeat themselves was like “Groundhog Day.” The new dashboard empowered agents by aggregating the information they were missing or currently keeping track of with pen and paper. By eliminating redundancy and cognitive load, the dashboard also empowered agents to be confident and informed in their own and customers’ eyes. This was in stark contrast to the earlier phase of work, in which agents had to look up the latest products and offerings on the website. This deflated their self-image as confident service professionals, because they had no specialized knowledge to offer potential customers calling in.



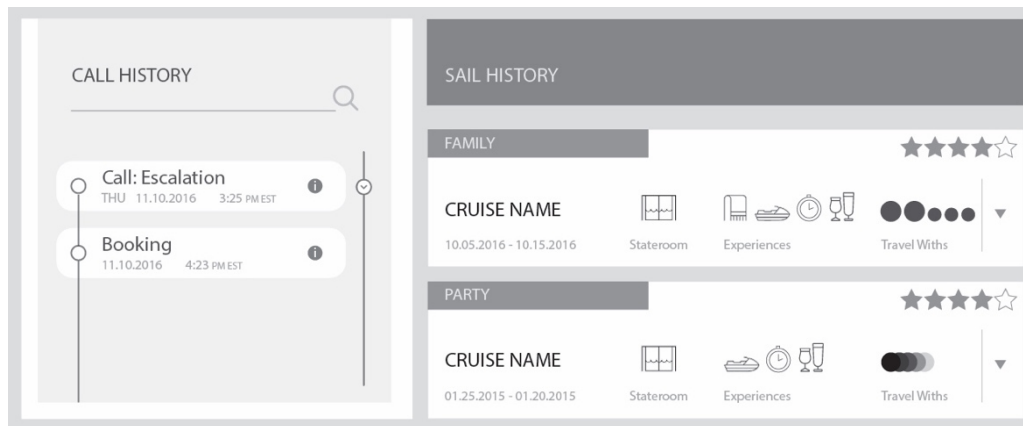


Figure 2. Aggregated view of call history and sail history

Later usability tests discovered that managers would rather walk around and coach agents rather than use the desktop-based tool. It was one of their favorite parts of the job. The team moved the interaction to a tablet device to support this behavior. By co-creating tools directly with workers, agency is preserved and enhanced through revealing the type, format, and timing of interaction which will support what people love about their jobs. In the cruise call center context in particular, feeling in-the-know was important to the sense of agency. By designing the content and instantiation of this tool to align with managers' desire to share expertise, the final design was more successful than earlier iterations.

In the hospital project, the first round of research led to a point of view of where to focus and iterate on the current system. Exercises and activities invited staff to co-design a better work environment for themselves. Allowing staff to participate in the design process gave them an opportunity to voice their opinions in a safe environment. Having an ethnographic understanding of the challenges led to more targeted questions, such as:

- What information is most meaningful to have access to? How is that different for each department and role? How should that information be communicated?
- Of your daily tasks, which do you enjoy doing and which should be automated? What needs to be true for you to trust that a computer could help do your job well?
- 

For the dashboard card sort exercise, a data scientist took the lead on determining available and desirable data points for four different views (Figure 3):

- Individual Patient View - Information about an individual patient
- Clinic View - Information about an individual clinic
- Global View - Information about the entire hospital care structure
- Notifications - Information you would like to be notified about

The team asked each staff member to individually choose three cards for each of the categories to determine what information was of greatest value to them in their unique roles. Besides recognizing patterns and differences within the data points chosen, the card sort served as a means to elicit how visibility into certain information could transform jobs and empower the hospital to provide better care as a whole and as individual clinicians.

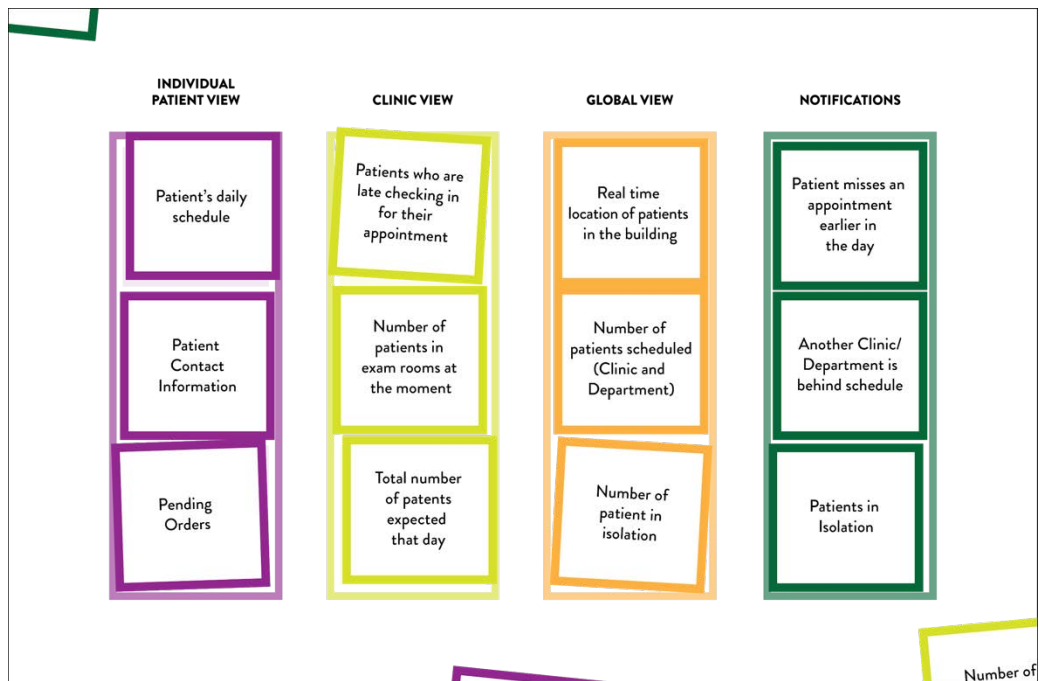


Figure 3. Dashboard card sort exercise to understand which information is relevant to staff in different departments and their requirements for receiving the information

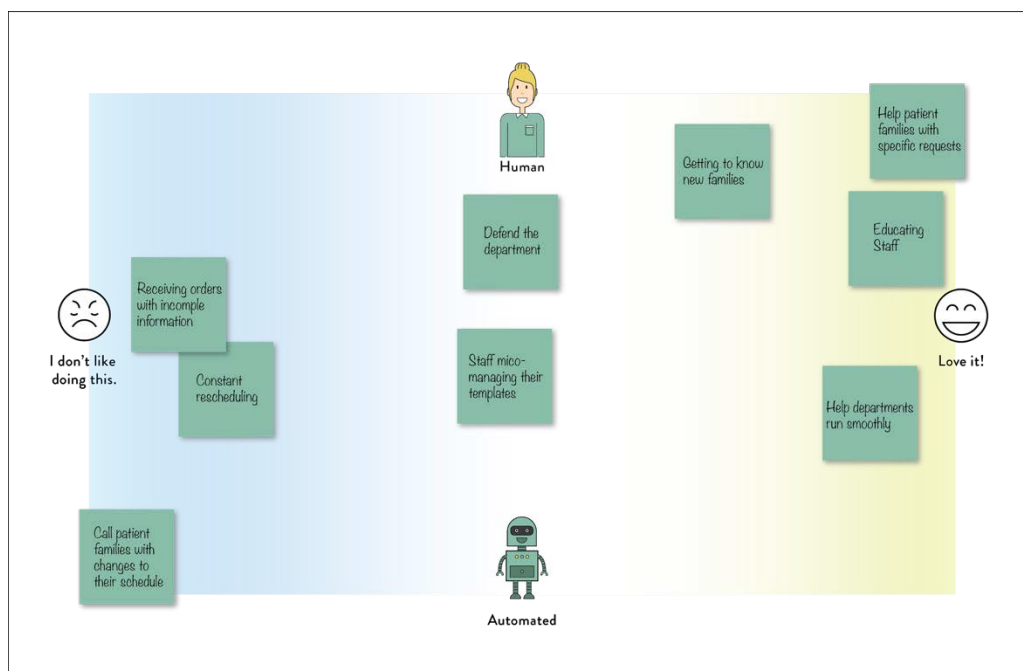


Figure 4. Exercise to elicit feedback about the desired role of automation

In another exercise (Figure 4) the team asked staff to use Post-its to write down their daily tasks and map them on a spectrum from: “I don’t like doing this” to “I love doing this.” Next the team introduced two characters, a human and a robot, and prompted staff with the question: “Which of these tasks do you want to continue doing yourself and which of them should be automated?”

Both exercises show how technology can enhance staff agency to improve the quality of care and the staff’s overall satisfaction with work. Through intentionally using technology, the number of undesired tasks in a clinician’s day is reduced. Automating tasks can optimize time on task and boost expertise by making relevant information accessible.

The second exercise led to deepening insights about which type of work providers valued most: tasks that cater directly to patients and their well-being rather than the background work required to deliver good care. Finding ways for staff to express and focus on what they consider to be meaningful work and finding ways to support them in doing more of that work, is therefore an appropriate use of technology within this work ecosystem.

Furthermore, there was a realization that providing agency in staff members’ daily tasks requires more than smart tools. Because a hospital environment is complex and involves a number of departments with different responsibilities, the team came up with a framework they referred to as ‘The Agency Loop’. This framework is a virtuous cycle which aims to keep agency constantly present by driving behavioral change and requires three pieces to be present: ability, permission, and motivation.

- Ability: Staff feel capable and confident in what to do
- Permission: Staff feel allowed to act and responsible for their decisions
- Motivation: Staff are willing to act, aware of the reasoning, and believe taking action matters

Designing better jobs requires involvement of staff beyond the duration of the project, a cultural shift that makes inclusive innovation the new norm and creates a safe and empowering environment for staff to share challenges, desires, and ideas. Staff must have confidence that change can happen, feel confident to speak up because it’s their role, and build practices for participation. Observations and conversations revealed awareness around what needs to change, but little incentive to do so. For example, nurses expressed that they feel like their hands are tied when it comes to dropping off a medication order at the pharmacy. They stand in line behind patient families, losing valuable time in the clinic, because that’s how this situation has always been handled. While staff were able to share creative solutions with the team, they felt a lack of permission was holding them back day-to-day, affecting their motivation to act on desired changes. Agency in the hospital means:

- Since patients’ diagnoses are uncertain, the work ecosystem must be flexible and transparent so staff can react appropriately.
- Providing visibility into existing data and patient updates across departments so that the staff is always up to date on their patient’s current health state, and the emotional burden of passing on this information doesn’t fall on families.

Second, designing tools with the worker and work ecosystem in mind can instill positive emotions, self-insight, and a sense of purpose, making it more likely that workers will

experience their job as a good one. In the mortgage services project, a voice analytics prototype gave agents the chance to reflect on which words they used most often on calls by displaying a word cloud. Being able to share issues and learn without fear of censure was particularly important to agency in a competitive work environment. The voice analytics prototype provided learning through a moment of self-reflection, without additionally monitoring agents. The tool was meant to improve the conversational variety of calls, and agents loved it because it provided them with instant feedback. Much easier than navigating a library of recorded calls for inspiration, they reported feeling more intentional and reflective simply because this automated tool mirrored their words back to them.

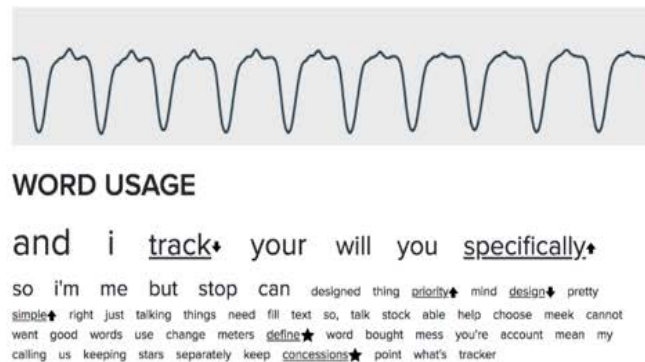


Figure 5. Displaying the language used on a call

Making custom medications in a hospital environment is a crucial because a small mistake can be fatal. Knowing patients are waiting creates additional pressure on the pharmacist. Instead of processing orders in the order in which they arrive, the team found that being able to process these relative to different patients' schedules would improve workflow and ease stress. The software refresh was designed to provide visibility into patients' schedules. By adding this information, the emotional relationship pharmacists had with the system was transformed into one that was more mutual and rewarding, rather than pharmacists feeling like they had to stick to the systems' outputs because they were missing information. The team learned that the system needed to be smarter about its outputs and indicate when and where there's flexibility to the schedule.

Agency for the pharmacist means being able to use common sense to judge which orders to prioritize instead of operating like a robot and processing orders as they come in. The ability to have a more holistic view into the patient's day and treatment and current state of health allowed pharmacists to connect with the patients, fulfilling the basic need of human to human connection. Furthermore, the ability to measure their own performance was important to recognize their own continuous growth and improvement. Returning to the "agency loop," having access to relevant data points allowed pharmacists to feel confident in their abilities, provided permission in making an informed decision, and motivated the pharmacist to act in service of what they believe is right.

Scheduling is a craft developed through years of experience. It's more than a clerical job, because the scheduler needs to understand all the ramifications of the medical procedures they are scheduling. For example, MRI appointments require sedation and therefore a

particular set of staff and equipment, as well as a recovery room. While staff take pride in mastering the puzzle-like appointment logistics, this task becomes tedious when it becomes a constant requirement. Schedulers described their job as “Wall Street,” working with multiple channels, constantly communicating with patients and providers to make small adjustments which will most likely change many more times. When the team introduced the idea of using AI to generate the most efficient schedule, freeing up time for schedulers to bring a human lens in addressing families’ needs and preferences, there was hesitation. Not because of a fear of AI taking over the jobs, but because schedulers didn’t trust AI to be able to do an equally good job as they would. They perceived the creation of a good schedule as a task that could only be done by an experienced human, not by a system. This pointed to the need for additional time for staff to build trust and confidence in new systems through testing and continual use. In the future, the work ecosystem could lead to higher efficiency, less work being re-done, and better care provided through meaningful schedules that resonate with patient needs. The ability to train new systems and build trust over time gives staff permission to re-evaluate their workflow and time commitment and shift their focus to crafting customized timelines for patients.

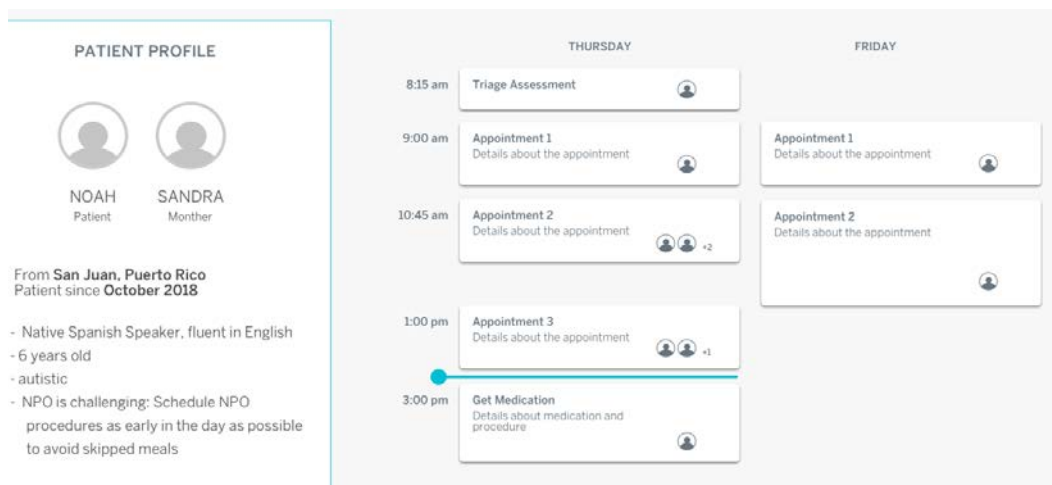


Figure 6. Holistic view into the patient’s entire schedule and profile information to provide relevant context across departments. Note: patient details are fictional.

Third, these projects highlight that in order to encourage worker agency, we must take an ecosystem perspective, designing for holistic and goal-aligned relationships between workers, tools, technologies, organizational structure, and incentives, among other levers which may be appropriate to the industry and company. In the mortgage services project, the team was responsible for crafting a new role. Since sales was mainly based on commission, and service on different, efficiency-based metrics, there was little leverage to incentivize collaboration and a new approach to homeowner relationships. The team considered the system, metrics, and incentives that workers were evaluated against, such as call time, transfers, and customer experience quality. Since agency in the mortgage services context meant a sense of progress in growth opportunities, and the ability to cement financial security through personal skills and charisma, it was particularly important that

agents had input and were comfortable with new metrics and incentive criteria. The role was designed to encourage long-term customer relationships by increasing base pay and the impact of customer experience quality ratings relative efficiency measures such as time and volume. Meanwhile, the job description and employee value proposition sought to target service-oriented internal hires.

On the cruise project, prototyping co-location of different roles heightened collaboration and improved the customer experience. It also provided an opportunity to elevate the sense of agency cruise call center employees derived from confidently projecting their expertise through how they interacted with each other. During a two-week test, one participant said, “As time went on, it chiseled down to the point where we were having legitimate real conversations. It went from you against me to us working together for the team.” One of the biggest worries was the incentive structure, so the team integrated organizational design. Incentivizing agents for good notes and assisted bookings helped to alleviate compensation concerns and facilitate the desired behavior shifts.

## **CONCLUSION: IMPLICATIONS FOR ETHNOGRAPHY AND DESIGN**

The literature and empirical cases together raise a number of questions about designing for worker agency in the US service economy. First, the relationship between automation and agency is often framed as a binary, but this tension is not necessarily helpful in understanding and designing for the complexity of workers’ motivations. Rather, the challenge for service design can be reframed as an informed, continuous process of decision-making around which parts of work to automate and script in order to improve workers’ jobs, and which parts to personalize or preserve in order to enhance what is meaningful. Second, the literature on ethnographic action research, capabilities, and affordances leads us to ask how innovation challenges in the field of service design are affected when we view work as an ecosystem. How might we view agency as relational and contextual to the specific work ecosystem, in order to prototype and design for how workers define it? Third, the projects and literature highlight the importance of continuous and active involvement of researchers, designers, and participants, in this case service economy workers in the tourism, financial, and medical sectors. The agency-related question is how to encourage engagement in a way that elicits meaningful bottom-up organizational change.

In order to embrace the potential of data and technology in creating better jobs, ethnography must map the systems and tools workers interact with, how they are using these, and identify which barriers should be redesigned. Siloed operating systems are a common problem in large organizations, compromising access to information in favor of the continuity of known operating systems. During the hospital project a cross-department workshop helped the team surface what information exists in the ecosystem and the desired flow of information. The goal overall was to ease the burden of job responsibilities and therefore ideally lead to a better patient experience. Similarly, the cruise ship project led to a comprehensive dashboard which pulls relevant information from multiple pre-existing systems into one central place, combining data points in a meaningful way and turning the dashboard into a tool that puts agents in control. Second, by inviting workers into the innovation process, their participation in research and co-creation sessions can become an act of agency in and of itself. Highly interactive exercises and prototypes like mapping workflow, crafting their own ideal dashboard, or immersion in a simulation of what their

future tools may look like, leads to better feedback, more willingness to participate, and ownership over the work that is being done. Involving workers in the design process also builds trust that their perspective matters and fuels design. The key to success is reminiscent of the researcher as social-cultural animator in ethnographic action research approaches, engaging with people in the research and design process in order to transform them into advocates of design work.

Designing for service workers' agency requires solutions which account not just for tools and products but also for the holistic structure of the organization. While data and technology may have the ability to stretch into staff responsibilities, ethnographic research unlocks the best use of its potential and finds ways for it to serve unmet needs. It is crucial to understand the essence of what makes work rewarding and meaningful as well as identify misalignments and gaps in meaning, purpose and the autonomy with worker's lives. In the cruise and hospital projects, it became apparent that the work people appreciate requires emotional intelligence and skills, and tasks that felt burdensome consumed unnecessary time in gathering and analyzing information across multiple sources. On the hospital project schedulers were excited about the potential of AI generating the most efficient schedule but lacked trust in it being able to do an equally good job as they would. The ability to train the system, allowing it to prove itself over time is therefore a key step in implementation. The cruise and mortgage projects depended on tools being aligned with the incentive structure within the company. The overlap between technological potential and staff needs reveals opportunities to design better jobs. Turning opportunity into action requires compatible tools, culture and incentives, addressing what needs to be true in order for the adoption of new workflows, processes or operating systems.

**Marta Cuciurean-Zapan** is a design researcher who focuses on building innovative research approaches, futures perspectives, and the intersection of content and culture in teamwork. Marta also teaches human centered research and design at DePaul University. She has a Master's in Cultural Anthropology from Temple University and a Bachelor's in Anthropology and Art Theory and Practice from Northwestern University. She is currently a Senior Design Lead at IDEO.

**Victoria Hammel** is a curious and passionate interaction designer, who loves finding the right balance of crafting with her hands, head and heart. With a great passion for humans and their stories, Victoria loves to meaningfully address their needs by finding simple, engaging, and non-intrusive solutions to complex problems.

## NOTES

The views expressed in this paper do not reflect those of IDEO or its clients.  
Illustration credit: IDEO

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## Agency and AI in Consulting

### Pathways to Prioritize Agency-Enhancing Automations

CENGİZ CEMALOĞLU, ReD Associates

JASMINE CHIA, Oxford University

JOSHUA TAM, IBM

*Amidst the advances of AI and automation, this paper provides a framework for ethnographic methods and insights to enhance human agency at work. Through analyzing data collected from ethnographic immersions in three different consulting firms (a professional services firm, a management consultancy, and a boutique insights agency), human-agent decisions are isolated in case studies and the pathways of unlocking the potential of automation to enhance the agency of individuals rather than constraining it are highlighted. Through drawing a distinction between thinking agency and executional agency present in the work of a consultant, this paper argues that automations that preserve thinking agency while maximizing productivity and accuracy are the solutions that should be adopted. Through vetting workflows sourced from ethnographic immersions with the established criteria, a framework for consultancies – and more broadly businesses – to better employ AI and automation is laid out and substantiated by an account of how anthropological approaches can be brought in to assist the process of prioritization among contextual automation processes.*

## PART 1: SETTING UP THE STAGE

### Mergers and Automation

The merger was a complex one. Two pharmaceutical companies were coming together – each with varying overseas footprints, each having molded their companies to face different regulatory environments. As their disparate US-based businesses were brought under a large parent company, they hired a management consultancy to capture the “synergies.” In other words, the consultants were hired to figure out a way to take as many costs as possible out of the merged company through removing duplicated resources and processes. *Naturally*, the first place to start was in the organization itself – deciding which employees to keep and which ones to let go of.

In the highly precarious process of a merger and an organizational restructuring, one thing was made evident – the corporation gave its very own employees very little agency in deciding their own futures. Yet, the executives of the same corporation chose to vest in consultants the power to advise on who gets to keep their job. In the business world of today, decision-making power is often concentrated at the top, and is distributed horizontally to other stakeholders – partners at consultancies or managing directors at banks. The consulting industry in 2017 generated \$63.2 billion (Shumsky 2018) from American institutions alone. Yet, the decision-making power so often delegated to the consultants is so rarely delegated downwards – to employees themselves. Therefore, under the boundaries of modern capitalism, the agency of the employee is often intimately intertwined with the work of a “consultant.” The consultant’s own agency – or their lack thereof – has more than significant downstream effects that ultimately reach the many thousands of employees in the businesses they consult for.

In the case of the pharmaceutical merger, the timeline for the restructuring was tight and it was a large, complicated organization that had a multi-country structure with similar business units in every country. Instead of thinking through a model change that might have driven a more optimal way of working - centralizing some core functions in the US business, moving to a shared services model for transactional roles, or changing their sales force structure - the consulting firm, with Excel as its only tool, took shortcuts to get to the reduction targets that the executives wanted. They fired managers who earned above a certain amount or directors who managed fewer than a certain number of people. Ultimately, the cuts were deep, but did not change the overly complex company structure – it only reduced the number of people at each given level.

Gaps began to appear a few months later, as it became evident that too many managers had been let go of, and ultimately the company's stock began to fall later that year as the firm began to experience severe shortages since their production lines had been disrupted.

Unfortunate stories like these are rumored to be becoming less and less frequent as consulting firms promise to become more technologically sophisticated. In the case of organizational restructuring, new AI tools like Anaplan or Orgbuilder allow consultants to run far more complicated models in envisioning the way a business might be structured in the future – creating opportunities for deep model changes like agile transformations. However, consultants increasingly find themselves less able to control all aspects of the data analysis, reducing their sense of agency. (Beck and Libert 2018) In an ideal universe, as the repetitive analytical elements of a consultant's labor begins to get increasingly automated, consultants could find new avenues to contribute – focusing on taking employee input into account, working with the employees themselves to improve their working lives, and other more human-facing functions. Yet, the way in which AI and automation is currently situated to impact the consulting industry is far removed from the optimistic aspirations of what AI will enable consultants to focus on. (Frank et al. 2017) Without prioritizing what types of AI can have the highest positive impact on consulting projects and instituting a set of expandable boundaries on what should and should not be automated, the impact is likely to be much more irreversible than consultants and technologists may have thought.

This paper explores how *agency*, agency of the consultants and indirectly the institutions and individuals they consult for, are affected by increasing adoption of AI and automation in the world of consulting. The paper differentiates two distinct forms of agency at play and structures the existing and potential effects of AI and automation on what we call "*thinking agency*" and "*executional agency*." Thinking agency is defined as the ability to freely ideate, while executional agency is defined as the ability to execute on or implement the agent's thoughts and ideas. The paper argues that the problemata in consulting is that oftentimes thinking agency is limited by executional agency, where unsophisticated tools of analysis impose artificial constraints on the answer set for a consultant's ideas, limiting and automating the possibilities of their recommendations and their ramifications. Stripping thinking agency, often also means stripping executional agency – not only indicating a lack of meaning and agency for the consultant, but an even more intensified lack of agency for the employees whose lives are being impacted.

As the financialization of the global economy accelerates rapidly, with corporations continuing to be bought out by private equity firms that then hire consultants to run these companies, it becomes increasingly apparent that AI and automation can easily remove even more human decision making out of the process, and out of the lives of the many employees

whose lives palpably change with acquisitions, reorganizations, and strategy shifts. (Libert and Beck 2017) It is our conviction that perhaps one of the few ways to forego such risks is to enable the adoption of technologies that retain, if not increase, the thinking agency of the consultants to ensure that the already very limited agency working professionals have left in their hands, isn't further limited.

## Literature Review

Agency is a tricky, powerful concept. In the face of society's totalizing regime of self-discipline, Foucault saw agency as the ability to subvert the "*micro-physics*" of the disciplinary regime. Power, in Foucault's conception, is not exerted by a single individual or group of people but rather produced and exercised by society as a whole. According to Foucault, "*each society has its regime of truth, its "general politics" of truth: that is, the types of discourse which it accepts and makes function as true, the mechanisms and instances which enable one to distinguish true and false statements, the means by which each is sanctioned; the techniques and procedures accorded value in the acquisition of truth; the status of those who are charged with saying what counts as true.*" (Foucault 1980, 109-133)

Therefore, agency in the face of this regime of truth is not simply a matter of finding a superseding "*absolute truth*" (as truth is a socially produced power) but a matter of constantly "*detaching the power of truth from the forms of hegemony, social, economic and cultural, within which it operates at the present time.*" Within the regime, power can be contested through evasion, subversion of contestation. Yet, agency, the belief of having agency, and the aspiration to attain it are also the "*truths*" of the Western societal canon, reified by the Bible all the way to self-improvement books of our modern days.

Therefore, agency is not exercised independent of disciplinary power, but within the context of existing structures and constraints of power. The freedom of choice and ability to act independently produces incremental effects on the broader system of self-discipline, creating "*localized episodes inscribed in history by the effects that it produces on the entire network in which it is caught up*" rather than through "*the law of all or nothing...not acquired one and for all by a new control of the apparatuses nor by a new functioning or a destruction of the institutions.*" (Foucault 1995, 27)

On the other hand, De Certeau, influenced by the likes of Bentham and Foucault, equally saw subjects bound up in broader systems that produced specific forms of practice to exercise agency in the face of domination. For De Certeau, there are two forms of practice: strategies and tactics. Strategies are employed by subjects with "*will and power*" due to their status in society giving them the ability to objectify others. "*A strategy assumes a place that can be circumscribed as a proper (propre) and thus serve as a basis for generating relations with an exterior distinct from it (competitors, adversaries, "clienteles," "targets," or "objects of research).*" (de Certeau 1984, xix)

In contrast, those who do not possess the "*will and power*" to employ strategies to shape external relations instead begin to assume a mode of practice that is tactical rather than strategic. Tactical agents express their agency through commonplace activities like reading or – in the case of workers – taking breaks at work, which re-signify and disrupt the order of activities dictated by the strategic practices of those in power. Therefore, there are infinite possibilities for contesting social order in the micro-physics of conflict taking place between the strategic and tactical practices of everyday life.

This is particularly relevant when thinking of agency within the corporation as workers remain deeply bound by the power structures beyond themselves and are consensually bound to mechanisms of self-discipline and self-surveillance that structure their agency. Within that, there is the constant opportunity to resist with a tactical mode of practice - to find ways to detach power from regimes of truth, and to temporarily invert power relations at continually arising points of conflicts. Therefore, when we discuss agency - the ability to make free choices - and losing agency - the perception of losing that capacity for making free choices and acting independently - we do so within the context of broader disciplinary forces that both constrain and create opportunities for resistance.

Taking into account the relevant literature, the phenomenon of “agency” for the purposes of this paper is then defined as:

*“the perception of a certain capacity for individuals or collectives of individuals to make free choices and to act independently within the existing societal structures and constraints of power.”*

First of all, agency is defined as a *perception* – as individuals and communities believe themselves to be agents as long as they are perceptive of their own agency. Additionally, the data collected through ethnographic methods and structured interviews can only verify or reject the perception of a certain capacity rather than the existence of lack thereof the capacity itself.

Agency is a *capacity* – it does not have to be enacted upon to exist, one merely needs to possess the potential, the capacity to enact upon it. That very capacity then in return enables the individual to feel the agency – an agency without the capacity is not agency, it is merely a wish or a will to have agency.

Agency can be possessed by *individuals* and *collectives* alike – individuals can have their own agency, yet collectives of individuals, or collectives of collectives may have their own as well. Countries, governments, institutions or businesses are a good example of this – where the collective agency of individuals is different than the agency of the community, the collective itself.

Agency is entirely about *free choice* and *independence* – it is about possessing the capacity to enact one’s own choices – with or without regard to others’ will. One can include others’ choices and depend on their acts, yet that choice of inclusion needs to be freely and independently made, at least perceived to be done so.

Lastly, it takes place *within the existing societal structures and constraints of power*, as it is a concept produced, protected, lost and reproduced in part as a part of and in part as an opposition to the existing societal structures and power constraints. Agency, ultimately, is enabled and allowed to exist as an oppositional force precisely due to the very structures and constraints containing the possibility for the emergence of oppositional forces within themselves.

To pursue a consistent analysis of the interlinkage between agency and automation – a precise definition of what is meant by agency is necessary, only through a unified definition, the conversations and experiences of interlocutors can be best analyzed.

What is then to “lose agency?” The process of losing agency is to lose the perception of that capacity to make free choices and to act independently. What is important to delineate here is that it is not about losing the capacity itself – it is about losing the perception of that

capacity. One may still have the capacity to act freely, yet if one has lost the feeling and the belief that one even has such a capacity – for all intents and purposes, agency has indeed been lost.

## Methodology

An interdisciplinary research project such as the one at hand necessitated a methodological approach that was, in nature, flexible. (Powers 2017) We borrowed methods, literature and modes of thinking from social sciences – predominantly anthropology – and philosophy and overlaid it with the modes of thinking and theories in computer science in an attempt towards illustrating the complex interlinkage between agency and technology.

The main source of data collection has been participant observation in three different consulting institutions – all of which have a presence in North America and Western Europe – authors delineate the difference between these three institutions by calling them a “a professional services firm,” “a management consultancy,” and “a boutique insights agency.”

Due to the sensitive nature of the ethnographies conducted, all the names of the institutions as well as all of the respondents have been anonymized. Immersions in the consultancies each lasted between two weeks to six months. Unstructured interviews and observational techniques were employed all throughout through spending extensive amount of time with more than 10 respondents in each of the three ecosystems. A conversational and reflective tone has been employed throughout the writing and structuring of the arguments to ensure the accessibility of the content both for academic and non-academic audiences.

The data has been mainly collected to substantiate our definition of “*having agency*” and “*losing agency*” as well as producing a thorough look at what it means to gain and lose agency. The collection of data on how consultants collect, analyze, and disseminate data has necessitated a level of meta-reflexivity – not only a level of reflexivity on our role as researchers studying professionals making decisions in professional environments, but also our role as consultants/researchers who also collect, analyze, and disseminate data in their past or present day-to-day lives. Reflecting on the nature of consulting, as current or ex-consultants, added a subjective layer upon the attempted objectivity of the research inquiry, which then nuanced and further substantiated argumentation.

Sprinkled throughout ethnographic narratives and the more analytical workflow analysis, readers will find evidence of this meta-reflexivity about the nature of consulting – and the present tensions between agency and lack thereof.

## PART 2: ETHNOGRAPHIC IMMERSIONS IN CONSULTING

### Boutique Insights Agency

Insight Co. is a small insights consultancy – merging user interviews with design thinking methods. With approximately 100 employees spread across six offices, the young firm’s growth has been relatively stable over the past few years. One of the HR representatives describes the employees of the firm as “*quirky and intellectual – with a refined taste and a broad interest in the world.*”

Besides lunchtime conversations, movie outings, and all-black uniform clothing, the way in which that refined taste and an interest in the world manifests itself during the day to day of the work experience is mainly through PowerPoint itself. One of the associates, Lena, says *"More than 60% of the time, I am on PowerPoint creating slides. I came to love it, but of course I cannot help to still resent it a little bit."*

When employees across different levels arrive to Insights Co. they receive a thorough design and PowerPoint skills education through workshops, online courses, and peer education. *"It starts with small questions – asking one another how to do relatively simple things – like how do you make a text visible on a photo? That's a tough nut."* adds Lena.

With a young workforce, Insights Co. immediately comes across as artistically inclined. The employees are wearing boxy shirts, designer glasses with retro aesthetics and talk about cinema, contemporary art, and new yoga classes in town during their free time between PowerPoint slides they are meant to produce.

During an early Thursday afternoon conversation at Insights Co., Steven, 34, one of the older employees at the firm who has been with Insights Co. for more than 5 years says *"there is joy in aligning things in a PowerPoint presentation, in building slides that look like what I imagine them to look like, in translating my ideas into great visuals."*

An overwhelming majority of Steven's day to day at Insights Co. involves PowerPoint – that is where he writes his sales pitches, that is where he communicates the insights researchers find about the world, that is where he proposes new initiatives or design principles to abide by for the variety of decision-makers at their client sites. *"I even have dreams about PowerPoint sometimes. It is such a big part of my life – in fact, I think of it as the most concrete thing that my job enables me to create – a solid deck,"* he adds.

Overhearing the conversation with Steven, Anne adds *"but PowerPoint is tedious, time consuming and complete waste of time – I'd rather spend time coming up with ideas rather than spending the time worrying over little details on a presentation."*

Anna, 28, comes from a background in Psychology – where she focused her studies and research on sources of motivation in the workplace and outside. While shadowing Anna at work, it becomes apparent that even when she is building a PowerPoint presentation – a task not at the very top of her priorities, she is still *"coming up with new ideas"* through thinking of new design ideas and sharing it with her colleagues.

Towards the very end of the research engagement at Insights Co., Elena appeared in the picture – a recent hire at Insights Co. who has a lot of opinions about PowerPoint from previous experiences. She says that a big majority of her time spent in front of PowerPoint is solely consistent of making small decisions about design, grammar, and content layout – *"decisions that matter but also don't matter at the same time."*

She adds, *"I would appreciate if PowerPoint gave me multiple suggestions for a decision I need to make – this way I could choose between them, and if I don't like any of them, then I could go ahead and build my own thing."*

Elena says that when it is about very small decisions like *"which line should go where, what color the box should be, what picture should I use to illustrate that idea"* she would benefit from a set of automated suggestions. *"A robot can do that, why do I need to spend time on it?"* she asks. She points out a new button that PowerPoint had introduced in her Mac version of the software, *"Insights."* – *"it is funny isn't it, what I do is insights, what PowerPoint does is also insights."*

She explains and shows that “*Insights*” suggest automated design and layout suggestions to her slides – it enables her to quickly build slides that she frequently uses but aren’t embedded in the template itself.

Anna comes over when Elena is displaying what the Insights button can accomplish and cracks a brief laugh. She joins the little demonstration and comments: “*I guess we will be displaced by AI sometime soon too.*”

“No way,” Steven says, “*all those robots cannot think like us – most importantly, they cannot think outside of the box like us.*”

What the fascinating interchange between Steven, Elena and Anna discursively points towards – along with many other conversations at Insights Co. and beyond that due to the limited scope of this paper, we have to exclude from depicting and discussing – is a distinction between **thinking agency** and **executional agency**.

Thinking agency is the freedom and the ability to think, to ideate – to come up with an idea independently and freely – discussing the idea, receiving feedback on it, and deciding to keep it as an idea or to bring it further to execution – like sharing with colleagues, clients, or taking active steps to build things out of this seemingly simple idea. What Anna is saying is that she would like to enact her thinking agency more frequently.

Executional agency, in contrast, is to build, and to create things – to execute things in the way an agent-being wants them to be executed. It is the freedom to build things the way one wants to build them. It usually directly follows the thinking agency, and occasionally co-exists alongside it.

What Elena is pointing towards is that she doesn’t mind if she receives some help when it comes to her executional agency but would not want her thinking agency to be influenced or interfered with in some way or another.

Our conversations throughout Insights Co. seemed to point towards an implicit agreement across most employees – that it is acceptable for executional agency to be partially reduced by AI, but when it comes to the thinking agency, no compromises are willing to be made. Instead of replacing the thinking agency, technology that provides speed, inspiration, and optionality to assist with executional agency makes one feel that one can still think, create and be the decision maker. That is exactly what Excel and PowerPoint do and did throughout history – they automated bore tasks that employees had to do manually for decades, and now they facilitate what we need to create – and assist consultants in creating mental models of how things should look like.

In the hierarchy of agencies individuals imagine possessing at work, thinking seems to come above the executional – and it the automation of the thinking that creates a loss of agency and consequently meaning at work, yet the loss of executional agency does not – necessarily. Our ethnographic immersion points to the fact that this is the careful line that automation will need to trace to ensure that its power is fully utilized, and its unintended consequences are not experienced widely.

## Management Consultancy

With offices around the globe and a well-established reputation – Management Co. is one of the largest consultancies in the world. The institutionalization of the brand that is built around running large-scale “*transformations*” – massive exercises that span portfolio rationalization, cost reduction, new go-to-market and growth strategies, as well as



organizational restructuring initiatives – became apparent already from the first day of our study.

*“The business is evolving,” commented George, a manager at the company, “nowadays, we sell bigger cases with multiple partners working on the same account - it’s an entirely new business model from the one-off projects we used to sell.”*

A key part of a transformation business is organizational restructuring – changing the way a company organizes its people. Especially when the transformation is a turnaround - taking the company from below margin performance to profitability with the help of organizational restructuring is where Management Co. finds the most “*efficiencies*” (i.e. the most money that can be saved for the company in the shortest amount of time) and the biggest amount of business opportunities. Many consultants at Management Co. describe this line of work as their “*most emotional work*,” both for the Management Co. consultants and the executives alike. Another manager, Aaron tells us: “*Organizational work is hard, and a lot can go wrong with it. It doesn’t feel good to do it, but at least when we do it, we know that we’re doing a much better job than what our clients would do if they were to do it by themselves.*”

However, a consultant’s ability to be thoughtful about “*org work*,” as it is colloquially termed, is limited by the data available to the consultant and the limitations on how that data can be processed. “*In most companies, a company’s annual operating budget plan is directionally aligned with but not connected to a company’s HR database,*” Aaron explains. This is a critical data limitation –because consultants make decisions on who stays and who goes based on the HR data with the aim of hitting reduction targets based out of the operating budget. When consultants walked us through a sample project they worked on, it became apparent that when the linkage between decisions made against the HR data on the spend baseline is unclear, consultants had to constantly engage in guesswork in determining how to get to their client’s required end results. As a result, consultants at Management Co. tend to “*over-deliver*” on the savings from the organization, which practically means firing more people than needed to hit reduction targets in the budget, to stay on the “*safe-side*” in terms of delivering on their proposed savings. “*We would rather cut a few more heads than have our clients not hit their EPS (earnings per share) targets,*” says George. “*If they don’t hit their EPS targets, then they’re answerable to the street - and coming in below investor expectations could really send a company into a downward spiral.*”

A senior manager, Luke, who has been with the firm for over ten years recalls a particular instance during one of our conversations. Management Co. was working on a project at a \$10B company with the aim of hitting a particular EPS target through cost reduction in the organization. They had worked with this company before and had completed a large organizational restructuring project for the company just a year prior to this project. However, the company’s revenues were still in decline, and they needed to cut more costs to keep profit margins constant.

The company built their annual budget on a “prior-year plus” methodology where they simply took the actual spend from the year before and assumed a certain percentage increase in spend across the organization. However, as a result, the budget for personnel spend had absolutely no connection with the bottom-up build of the organization – “*salary by person view presented huge difficulties in terms of executional agency for both the clients and the consultants.*” In the previous round of organizational restructuring, Management Co. had avoided dealing with the data complexity by only using the bottom-up HR data to inform decision-making and

had massively over-delivered on savings from the organization. *“It was touted as a huge win for the client,”* recalls Luke.

As Management Co. set to work on this second phase of the restructuring, however, they attempted to solve the problem they had faced in the first phase by introducing a new AI tool that enabled Integrated Business Planning (IBP). The team took the various existing master data structures and fed them into the tool, which output the data in standardized formats. More importantly, the tool provided a platform with user interfaces for the finance, HR, sourcing and commercial functions that meant the budget-planning could be done using the same bottoms-up methodology across all functions. Management Co. consultants introduced this at the beginning of the company’s budget planning cycle, so by the time the restructuring had to be in full swing, the datasets were ready to use.

What emerged from this exercise was a surprising insight on the organization: that the “prior-year plus” methodology of budgeting had hidden the fact that most of the personnel spend budgeted in the annual operating budget of the company was from open positions, roles that had been left vacant by recent exits. Luke explained, *“this became evident as the consultants were able to link the budget costs back to the specific personnel roles that were driving them, only to find out that these roles weren’t actually filled by existing employees in the organization.”* What had happened was, unbeknownst to the executives at the company, the company had been facing a huge loss of talent as their revenues had declined, and the last round of restructuring had actually left the company vastly under-resourced in terms of delivering on their products. As talented employees began to feel stretched, they began to burn out and leave the company. Because executives hadn’t responded to the exodus, employees felt like they didn’t care, and abandoned the firm even in higher numbers.

*“This insight completely turned around our project, and instead of a cost-cutting exercise the project became an exercise in finding talent and building a leadership structure that could support talent development in the company’s near future,”* Luke adds. People were promoted to positions that were befitting of the responsibilities they had begun to take on in the lean organization, and more aggressive bonuses were put in place to provide incentives for employees to stay on.

Changing the way data was made available to the consultants completely changed the process and the outcome of their work – it enabled them to enable the employees themselves. Data showed how massively crucial it was to address the growing feeling of powerlessness among the employees to voice their concerns about the rapidly thinning organization.

*“Once the problem was pinpointed, executives hastened to conduct town halls and leadership forums to hear how their employees were feeling and to institute better policies and processes for employee feedback to reach to the top,”* Luke recalled.

Results like these are common Luke says, as managers in the organizational restructuring group of the Management Co. increasingly utilize new AI tools – like Alteryx, Anaplan, and Orgbuilder. These tools have been welcomed across the industry by the consultants, and the clients alike – for more precise, and more consistent results.

Foucault had said that *“agency is the ability to overthrow the micro-physics of the disciplinary regime that power exercises on the body through “localized episodes inscribed in history by the effects that it induces on the entire network in which it is caught up” not “the law of all or nothing...not acquired one and for all by a new control of the apparatuses nor by a new functioning or a destruction of the institutions.”* (Foucault 1995, 27) In line with his definition, in this particular case AI was simply perceived to lead to an incremental discovery which allowed consultants to drive the organization towards

broader change – it enhanced both the thinking agency and the executorial agency. No consultant we talked to at Management Co. mentioned any concern about their agency being lost or diminished. *“The AI makes sure that we implement change in the most effective way, it is helping us not replacing us,”* a consultant, Jessica, reflects. Luke adds *“sometimes we have consultants who complain that they feel that the change they bring isn’t necessarily positive, in this case the AI helped us bring the most positive outcome for both employees and the corporation.”*

When reading between the lines consultants at Management Co. mostly focused on **efficiency** instead – *“AI helps us be faster”* a consultant mentioned, *“it allows us to focus on what actually matters”* another one added. *“With more time in our hands, we can focus on making sure that the change we suggest is implemented correctly,”* adds Luke. Another consultant who worked on the case suggested that the case *“was a favorite of mine – it merged cutting edge AI with a focus on people and speedily delivering the best possible outcome for everyone involved.”*

Afterall, the automation at Management Co. illustrates the perceived joys of being effective, efficient, and innovative during a consulting project. A project which can pose to be a perfect metaphor for a corporate structure populated by employees with little agency – co-existing within a Foucauldian panopticon of self-surveillance, self-discipline and normalization of a certain standard of being. A standard of being that is often mediated by consultants who come in from the top and institute top-down policies with inputs from executives, (and now algorithms) which often serve to re-instate the processes of administration, social sorting and simulation. Yet, when done efficiently – in the minds of the consultants at Management Co., efficiency transforms into effectivity – a justification of the labor involved, facilitated by AI, automation, and a host of other technologized interventions. Ultimately, the series of conversations at Management Co. illustrate that perhaps an increased usage of AI can indeed serve to highlight and enable resistance to existing infrastructures of power when mediated through the discourse of efficiency, and consequently to make consultants a force for driving this resistance and finding more meaning in their labor.

## Professional Services Firm

Technology Co. is a large professional services firm that seeks to build out and ensure client success through delivery and implementation of technology infrastructure. With more than 100,000 employees across the world, Technology Co. delivers a variety of services across various industries such as building or redefining enterprise software in order to cut overhead costs in businesses, increase employee engagement and productivity in a business, and reduce instability and variance in any given workstreams.

One of the main business lines that Technology Co. offers where many of its best technology consultants work is in implementing AI/Automation services to different clients across different industries and practices. In order to effectively define how technology can improve business processes, a downstream modelling effort is executed to bring these services to different firms.

During our immersions and interviews with Technology Co. consultants, a representative case stood out – a Public Health Client that was looking to completely innovate its best practices and methods on understanding how to predict and prevent adverse events with blood transfusions and vaccinations in the American population.

Jack, a consultant familiar with the project explained *“naturally, one of the first things to do was to do a deep dive into existing technologies – with an unprecedented amount of research being done on oncology and genomics with AI – this would only seem natural.”*

In theory, the project was to undertake a simple task of modeling that had shown promise in similar datasets and fields. In reality, there were many different workstreams and personnel that not only utilized automation to increase thinking agency and throughput, but developed automation in a thoughtful yet exacting manner that sought to increase agency for its end users. Similar to Insights Co., thinking agency is opened up by increasing technological processes into a workstream, which promotes and inspires unprecedented growth and creative devices that would have otherwise been undiscovered.

In order to implement AI and automation into predicting how vaccinations and transfusions cause adverse events, one of the main responsibilities was having the Product Owner, Evan (who has a data science background), discuss the direction and strategy of the product. This entailed client management, strategic decision making, and scoping the realistic load of work that was contained. He reflects: *“the core principles of design thinking which include a focus on user outcomes, multidisciplinary teams and restless reinvention were considered.”*

Even reflected that, in many ways the Product Owner position was a balancing act of technical and qualitative information. He felt that he can design and craft narratives to tell a story in a uniquely humanistic way: the direction cannot be altered by AI simply because there is very little work that AI and automation can take on in the job description of a Product Owner. However, Evan also noted that the tools that automation has increased throughput in have helped him organize and collect his thoughts where necessary: *“When I’m working as a Product Owner, there are very few moments where I’m not talking to someone about prioritizing features and targeting correct users. In the moments that I have a chance to catch my breath, I’m really glad that there are tools such as PowerPoint or Trello to save me from manually loading in and recording notes, recordings, or thoughts. And I think it’s amazing that while these programs serve as platforms for me to work on, they are using limitless amounts of automation and AI under the hood that helps me categorize my original ideas into concrete and written conclusions.”*

Consultants at Technology Co. explain that in order to have an effective product, there must be subject matter experts and social scientists under the product owner who serve as the main point of contacts on user engagement and stakeholder analysis. These subject matter experts, Jenn and Jordan, were often the main drivers in research of current vs future work, as well as how technology will change a doctor’s motivation behind using given software. In a given workflow, subject matter experts sculpt a project into a more refined state. But, according to Evan how these subject matter experts extract information has changed dramatically over the past couple years as a result of automation.

Normally, subject matter experts extracted information from various sources across journals, papers, media, and the internet. Yet the way they engage with platforms like Google, NCBI, or Nature is drastically different from how a product owner may engage with the same sources. For example, Jenn explains that a subject matter expertise may ask a question along the realms of *“For a given type of Blood Transfusion, what is the expected duration of the effects before a treatment is in place?”* in order to understand how long of a timespan doctors, and by extension the program, should be wary of when designing features. A product owner, on the other hand, may ask the same question as *“For a given transfusion, how do doctors assess severity and potential adverse reactions?”*

A product owner can guide how a project may steer, but the subject matter experts bring in relevant and contextual information that technologists and AI enthusiasts may not understand from the get-go. In many ways, information extraction is improved from AI and automation in finding relevant and concise sources for specific questions. In the plethora of data available in academia and in business, finding the correct information is a task in and of itself: only when enhanced AI is connected with the right personnel can information be correctly identified and efficiently stored. In other words, increased **accuracy and rigor** enabled thinking agency to be increased by allowing subject matter experts to grab and engage with content that would otherwise be lost in the vast amounts of information available. *“When we know that the algorithm is making no mistakes – then subject matter experts can do a better job at fulfilling their responsibilities,”* says Jordan. *“If the AI can add rigor to our analyses and do it in without errors – that’s already more than enough,”* adds Jenn.

Once the ideation and design around how these predictions, platforms, and workstreams are defined, developers and data scientists begin to lay the groundwork of executing the vision. In many regards, working directly with technology is conducive towards automation and AI. For this particular project, Eric, Aaron, and Brian, three men with old-fashioned glasses and firm handshakes led this aspect of the project. Discussing their precise positions within the project with them illustrated a couple important points of discussion. First, data mining and data exploration are a blend of thinking and executional agency: how developers decide what to visualize or what kind of results to query cannot be simply *“inputted into automation with an expected output.”* These results must be carefully crafted in order to achieve results that will help the end user. Secondly, as Aaron noted, *“many people expect that technology is going to replace workers in every form of work because of popular media- the truth of the matter is that technology is meant to help us, not hinder us, in designing and creating different forms of work.”* We will explore this later in the discussion, but through our preliminary analyses, we have noticed that this sentiment prevails throughout multiple firms and workstreams. Accuracy comes forth yet again – as a more technology-savvy consultant, Brian articulates that for error-free outputs, there needs to be error-free inputs first and embarks on a long-winded monologue to communicate a previously articulated worry about biases and errors in AI technologies (Osoba and Wesler 2017). He says: *“Automation can only help us extract the correct information we need to work only when we, as developers, create the right kind of contextual information. Automation can only hinder us when we incorrectly identify the most salient pieces of information that can help us.”*

In many ways, the modeling and conclusion portion of massive automation projects seem the priviest to automation. Because of the high experience barrier that comes with statistical modeling, one of the many challenges for companies across the world has been designing intuitive and interactive code bases that are flexible in nature, yet intuitive enough for novices in statistics to understand. As a result, technology companies like Technology Co. are creating *“libraries,”* or code bases, that convert thousands of lines of code into digestible chunks that requires only peripheral information to implement. Models such as LASSO or AlexNet (statistical models used to identify and classify different kinds of information), which have taken decades of research to implement and design, can now be coded up in less than 10 lines of code. Eric, who has led the modeling efforts from the development side, notes something about this new wave of code simplification however:

*“We don’t need to always build [models] from the ground up every time we want to test a model. In many ways, automating model building allows us to test an unprecedented amount of crazy and outlandish models that would otherwise have been either too resource-intensive or too absurd to reasonably test. And in*

*many ways, we're discovering now that these outlier models that would have otherwise been completely relegated have provided promising, yet slightly unintuitive, results. The journey in automation isn't how can we eliminate work- it's all about how much possible work can we accomplish with new tools at our aide."*

Technology Co. and its employees are illustrative of how executional and thinking agency can be deeply intertwined – in their union, agency in implementing automation is inspired by ways to increase the accuracy and the quality of their work. This same inspiration motivates end users of these services to feel that while AI and automation have been thought of as detractors to human labor, when implemented in a prioritized and effective way they are meant to augment thinking and creative processes that are otherwise deprioritized and crushed under the tedious work that defines an average workday in the current definition of work within Technology Co.

### **PART 3: PINPOINTING AGENCY-ENHANCING AUTOMATIONS**

#### **Four Common Processes and 33 Steps in Between**

The relation between agency and automation manifests itself in a variety of ways under the different conditions outlined in the ethnographic immersions. Agency doesn't only interact with automation differently – it is understood differently by the various actors in the process. In Technology Co., agency takes on a temporal element as Evan is empowered by time-saving tools, at Management Co. agency is understood as a deeply relational concept involving both the consultant and the employee. At Insights Co., Ann finds agency in constructing ideas, unlocking a creativity that isn't quite as important for Evan or Management Co.'s Jess.

Amidst these variegated perceptions of agency, its meanings and its effects, how can we find common ground upon which to build a productive typology for enhancing agency – in our original, broad conception – by using automation?

Across the three firms, ethnographic immersions were supplemented with unstructured interviews with provide us a starting point with which to begin this inquiry. From these interviews, we have identified “33 common processes” that take place across each firm and have clustered these processes into four overall categories or ‘phases’ that a typical consulting project goes through.

In doing so, we attempt to construct a typology for ‘agency-enhancing automations’ – a way to prioritize automations which we should look to embrace and automations we should approach with particular sensitivity. The goal is for institutions of various types – whether they are more similar to Insights Co., Management Co., or Technology Co., or operate outside of the field of consulting entirely – to understand the breadth of processes that take place at an individual level and how one can begin to narrow down which processes should be automated and which shouldn't.

To that end, a set of steps taken in an average project at Insights Co., Management Co. and Technology Co. have been listed below:

**Table 1: Longlist of workflows across three consultancies**

<b>Insights Co.</b>	<b>Management Co.</b>	<b>Technology Co.</b>
preparing a questionnaire	writing an interview guide	setting objectives
choosing the appropriate pictures for a presentation	conducting belief audits	producing project plans
choosing the color palette of a deck	requesting data	setting success criteria
writing weekly touchpoint emails	cleaning data	setting quantifiable metrics for business and data success criteria
agreeing on an overall value proposition	analyzing data	assessing personnel, resources, and data
deciding on how to visualize ideas	choosing relevant data cuts to present	creating calendar and timeline for deployment
running a mock interview	looking for themes across relevant data cuts	shaping data according to regulatory compliance
conducting qualitative interviews	compiling quote banks	deciding key visualizations for client presentation
running a workshop	looking for themes across relevant quotes	generating hypotheses on different modeling techniques, business propositions, and data characterization
deciding on the format of a workshop	shelling out a deck with an overall story	responding to task orders and proposals

writing appropriate headlines for each slide	selecting key themes that encapsulate story	identifying potential risks
deciding when to start analysis	selecting icons to accompany key themes	defining business and technical requirements, assumption, and constraints
clustering observations	looking through research database for similar / relevant material to the case	creating data, business, and technical dictionaries for internal and client documentation
writing out an insights story	conducting expert interviews	creating a narrative in client presentation and decks
developing a 100-slide deck	scheduling time with multiple partners to review content	creating initial data characterization and quality reports
booking flight tickets	scheduling time with case team managers to review content	extracting salient information, features, and properties for analysis
booking hotel reservations	reviewing project budget	including/excluding information based on subject matter expertise
calling research participants to check-in prior to an engagement	parsing out partner feedback to relevant analysts / associates to turn comments	data wrangling to make data presentable
deriving a method to test findings	compiling slides from different analysts / associates into one deck	combining and aggregating various datasets together
choosing a partner to implement suggestions	making formatting consistent across different slides	deciding, constructing, and tuning model analysis and assumptions
wearing appropriate clothing for the presentation	scheduling touchpoints with client counterpart pre-steerco	creating modeling explanations and critiques based on quantitative and qualitative results



choosing which client to communicate x with	scheduling steerco	synthesizing results and forming a set of recommendations for clients on implementation and solutioning
proofreading written documents	qualitatively communicating client / partner feedback across the team	creating pros/cons list based on each model/decision made
filming an instance during research	refining data cuts / answering additional questions from clients / partners	documenting and training personnel to execute on formed decision
photographing an instance during research	removing extraneous slides from the deck for the final presentation	overseeing service and maintenance of decision/deployment
writing down a quote during research	sending out pre-read to clients	debriefing meeting internally and with clients on the risks, challenges, and continuation of projects
asking the right follow-up question during research	preparing talking points for each slide for the presentation	providing feedback to team members
choosing the appropriate people to join the team	presenting to steerco	measuring impact
evaluating team members	giving feedback to team members / case leadership / firm leadership about the case	managing project budget
giving mid-term feedback	conducting sustainability pulse check survey and discussion	requesting relevant data

When observed across consultancies – the tasks and workflows can be clustered into four categories – 1) gathering information, 2) analyzing information, 3) communicating conclusions, and 4) project logistics. The phases of an average project in the world of consulting would look like the following:

*Set-up and gathering information* – is the totality of the project set-up, getting the right data and workflows in place. This phase sets up the team for success or failure from the very beginning and includes a variety of logistical tasks that generally require executional agency as well as some thinking agency in key moments like “*team meetings*.”

*Analyzing information and deriving conclusions* – is when the data gathered is being analyzed qualitatively or quantitatively to come up with a set of conclusions to be communicated with the client. There are ongoing meetings throughout the process to communicate initial findings and conclusions – this is a phase with many workflows where thinking agency and executional agency are intertwined.

*Communicating and action on conclusions* – this is the final deliverable package, handoff generation process – where consultants communicate initial and final findings – the tasks tend to include creating presentations, pitches, agreeing on collaboration methods for going forward etc. – executional agency in creating the conclusions, based on the thinking agency involved in ideating them.

*Project logistics* – these are the set of internal facing tasks that necessitate a healthy flow of a project and are almost entirely logistical, like booking hotels, filing expenses, printing decks, and giving feedback to each other during and after the end of a project.

## Establishing a Set of Criteria

Upon conducting three ethnographic immersions across different types of consultancies, consulting anthropological and data scientific literature – we propose three criteria to evaluate each proposed automation and AI in the world of consulting to prioritize between different automation and AI technologies at different points of an average project.

- A. **Thinking or Executional** – does automating workflow X decrease thinking or executional agency?
- B. **Productivity-Enhancing** – does automating workflow X enhance productivity?
- C. **Accuracy-Enhancing** – does automating workflow X enhance accuracy?

We argue that a workflow should be automated, if the following three conditions hold true:

1. **Automating workflow X may lead to decreasing executional agency, but not thinking agency** – ethnographic immersions, unstructured interviews, and industry research point towards the automation of executional agency contributing very little to the sense of losing agency, while automating thinking agency to be a major contributor to the sense of losing agency. Automations that retain thinking agency and only automate executional agency should be prioritized.
2. **Automating workflow X enhances productivity** – technical literature already establishes the role of automation as a productivity-enhancing mechanism, yet ethnographic immersions showcase that when automation enhances productivity – the individuals mentally convince themselves that they are able to better focus on tasks that actually matter, and it frees up more time to focus on things that cannot be/will not be automated.
3. **Automating workflow X enhances accuracy** – technical literature in machine learning and AI, as well as ethnographic immersions also suggest automation's role in ensuring consistency and a sense of accuracy – ethnographic immersions showcase that one of the biggest perceived shortcomings of manual processes are a

lack of consistency, quality, and accuracy. Whether it being minor mistakes in Excel or typos on a PowerPoint or more major decisions.

Therefore, workflows in consulting that needs to be prioritized for automation are the ones that 1) involves mostly executional agency, 2) automating it enhances productivity, and 3) automating it enhances accuracy.

For example, as we walk through the 33 steps at Management Co., slightly less than half of these steps can be automated: these include more straightforward steps that could be more accurately and productively done by a machine e.g. scheduling time with partners / clients / team, selecting icons to accompany key themes, formatting consistently across the deck. However, the set of criteria defined above also helps define some less straightforward steps that can and should be automated: looking for themes across relevant quotes or looking for themes across the various data cuts. For example, a python script applied to all the words in all the interviews to identify themes on the basis of word count can highlight new and interesting insights that may not be available to the consultant, whose perceptions of the interviews are deeply formed by their own experiences with the interviewees, and the interviewee's tone of voice or emphasis. Taking a more creative approach that abstracts from that may not only enhance accuracy, but also give the consultant more leverage or 'thinking agency' to draw out something interesting about the story instead of just regurgitating key data points.

Here lies the specific point about executional agency – on first brush, executional agency may seem more limited than it actually is. For example, a task requiring 'synthesis' – that is, identifying themes across data – is often taken to be one requiring thinking agency, a strong capacity to critically analyze and conclude a specific story from a set of given data points. However, the rise of automation and new technologies is changing what can be 'executed', and that should condition how organizations think about using technology. By looking at concrete data points within the 33 processes we outline, we find that there are always higher levels at which to apply thinking agency – in the example above, moving from applying thinking agency to 'synthesis' to applying thinking agency to identifying nuances within the data.

A set of additional more nuanced criteria can be introduced to further nuance the prioritization of which automations to pursue and which automations to de-prioritize, however the main three clusters that seem to matter for the individuals' own descriptions of their own workflows and agencies – these three stand out – they ensure that the productivity and accuracy enhancing aims of automation and AI are fulfilled while the agency and the connected lack of purpose and meaning aren't lost from one's labor.

## **Discussion and Implications**

In this analysis, we have taken on three different instances of how AI and automation have increased the throughput and quality of workstreams in designing presentations (Insights Co.), uncovering and inspiring transparency in work that has otherwise been mired in bureaucracy (Management Co.), and in the assessment and creation of the tools that use AI and automation (Technology Co.).

In order to understand the implication of agency and AI, we refer back to the original definition of agency defined in this paper:

“the perception of a certain capacity for individuals to make free choices and to act independently within the existing societal structures and constraints of power.”

Popular culture depicts AI and automation as technologies that will overpower human agency. While AI enthusiasts are excited at the pace of growth in technology such as self-driving cars, cryptocurrency, and tumor detection in cancer, they are quick to note how AI is “narrow” in nature, and how this will most likely not change in the future. We quickly delve into Narrow AI below.

Narrow AI is the ability for AI and automation to do a task repeatedly with either a defined logic that is manually written by humans, or by an algorithm that is designed by a human. Very rarely are there instances of an AI algorithm that can accomplish multiple tasks without serious revamping or a serious overhaul. Steve Wozniak sums up the current challenge in AI and automation as:

“Could a computer make a cup of coffee? You could come into my house and you’d be able to make a cup of coffee...you’d have to ask a couple questions, but you could get there. But the steps to get there is built up over a lifetime of knowledge and information... when is a computer going to get to that level?... what a human being is so far above anything we’ve ever done.” (Wozniak 2010)

The work that has been accomplished at all three of the consulting firms investigated in automation is not to create decisions and strategies behind business processes - rather, it is to aid in contextualizing relationships between entities and predict outcomes as a result of data collected by humans with the aid of other automated tasks. New technologies change the ‘executorial’ potential of AI and automation, increasing the depth of AI within its narrowness, but human knowledge is required to broaden that scope and elevate insights taken from the data. Agency is best exemplified in the scoping and ideation of work that is done and having a form of automation/AI that can replace this, or at least create the perception of replacement, is unlikely in the near future. In short, automation is an incredibly nuanced definition that often is much narrower in scope, capabilities, and scale and that remains highly dependent on humanistic elements such as context, assumptions, and subject expertise, where agency truly shines.

We are now at a crossroads – we have heavily emphasized how thinking agency is increased, but rarely inspired a conversation around executorial agency, which revolves around building out different forms of presentations, visualizations, and analyses that are now created as a result of an increase in thinking agency. The most susceptible form of agency, as present by Technology Co. and Insights Co., is executorial agency. But the beauty of executorial agency is that this definition – that is, the creation and execution of events the way an agent would like it to be executed – fits the very scope that automation and AI can currently be created for. By repositioning the resource allocation of our work from the creation of a PowerPoint deck, stubbornly attempting to fit a re-org framework into a company that had problems elsewhere, or from the laborious tasks of recreating models from the ground up with little room for experimentation and hypothesis testing, the balance of executorial agency getting limited by automation and AI and thinking agency can best be thought of in terms of value proposition created for the clients consultants serve.

If the mission of a consultant's work is to create the largest value proposition for the clients, consulting firms are brought in not to create and design slides with a focus on stylistic content – it is to provide value in a way of providing external perspectives, connecting and managing resources available to the client, and achieving a mission. How that mission can be achieved has often been in the way of creating one-framework-fits-all, with the time spent in that framework on creating the underlying tedious details that create tenuous connections to the framework. With the trade off in executional agency in return for thinking agency, however, consultants are now able to provide a newfound value for their clients in way of hypothesis space expansion and experimentation. We, as the researchers, all current or ex-consultants have sought different forms of direction and patterns in our work using similar automated software in the pursuit of this value creation that all stem from the increase of thinking agency.

In these three firms, we have demonstrated that human agency and the perceived loss of free will and decision making can be counteracted by understanding the realities of automation. Without a proper scope defined by humans, automation will not lead to productive or efficient results. Without the proper data mining and infrastructure, automation will be susceptible to high variance and outliers. These results will, counterintuitively, decrease trust in automation, which may then further reduce human agency by lumbering decision making in the highly tedious and transactional tasks at hand.

In many ways, big data and automation have created human agencies in pockets of emotional and cognitive functions that were otherwise unidentified both in the workplace and in personal life. As Wozniak has described, simple and mundane decisions that are subconscious to us accumulate over a lifetime, creating a wholly unique decision process and autonomy. However, as defined in the discussion, automation possesses an incredibly nuanced definition that often is much narrower in scope, capabilities, and scalability which is highly dependent on context, assumptions, and subject expertise. As a result, human agency – both thinking and executional – can be argued to increase simply by the virtue of setting up, intuiting, and working on the foundation of various autonomous tasks, and understanding/strategizing collaborative and cognitive tasks that are otherwise unavailable within AI and automation processes.

**Cengiz Cemaloglu** is a consultant at ReD Associates. He holds a BA in Anthropology and Government from Harvard University.

**Jasmine Chia** is pursuing her MPhil in International Relations at Oxford University. She was previously an associate at Boston Consulting Group. She holds a BA in Government and Religion from Harvard University.

**Joshua Tam** is a cognitive consultant at IBM. He holds a BSE in Operations Research and Financial Engineering from Princeton University.

## NOTES

The opinions and positions represented in this paper are not the official positions of authors' employers, and solely represent the authors' own opinions. The authors thank all of the interlocutors and institutions involved in opening up their doors for the research inquiry.

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# Supporting Real-Time Contextual Inquiry through Sensor Data

KATERINA GORKOVENKO, *University of Edinburgh*

DAN BURNETT, *Lancaster University*

DAVE MURRAY-RUST, *University of Edinburgh*

JAMES THORP, *Lancaster University*

DANIEL RICHARDS, *Lancaster University*

*A key challenge in carrying out product design research is obtaining rich contextual information about use in the wild. We present a method that algorithmically mediates between participants, researchers, and objects in order to enable real-time collaborative sensemaking. It facilitates contextual inquiry, revealing behaviours and motivations that frame product use in the wild. In particular, we are interested in developing a practice of use driven design, where products become research tools that generate design insights grounded in user experiences. The value of this method was explored through the deployment of a collection of Bluetooth speakers that capture and stream live data to remote but co-present researchers about their movement and operation. Researchers monitored a visualisation of the real-time data to build up a picture of how the speakers were being used, responding to moments of activity within the data, initiating text conversations and prompting participants to capture photos and video. Based on the findings of this explorative study, we discuss the value of this method, how it compares to contemporary research practices, and the potential of machine learning to scale it up for use within industrial contexts. As greater agency is given to both objects and algorithms, we explore ways to empower ethnographers and participants to actively collaborate within remote real-time research.*

## INTRODUCTION

It is challenging to gain an understanding of the complex relationships between people and things due to the rich and messy intricacies of everyday life. The development of remote *in the wild* research methods across fields such as *ethnography* and *human computer interaction* (HCI) can help unravel some of these complexities in a contextually grounded manner (Anderson et al 2009; Crabtree et al. 2013). Research methods, such as design ethnography allow us to identify how design can help address people's needs (Salvador, Bell, and Anderson 1999). While the knowledge we gather from ethnographic research is rich, contextually grounded, and benefits from minimal disruption to the lives of participants, it is currently difficult and costly to implement at a large scale. Contemporary design ethnography practices, such as *thing ethnography*, *ethno-mining*, and *Ethnobot*, offer promising new directions for remote ethnographic research, with potential to be scaled up. Meanwhile HCI research methods such as experience sampling and diary studies, can be implemented at scale, but often rely on recall and self-reporting (Brown, Sellen and O'Hara 2000; Csikszentmihalyi, Rathunde and Whalen 1993; Gennip, Hoven and Markopoulos 2015).

The development of ever smaller and cheaper sensors, which can be embedded within products brings about new opportunities for industry and researchers to understand how

objects are used in the wild. Here we investigate how to enlist connected devices that track the ways they are used as co-ethnographers. These devices transmit live data in order to reveal the motivations, behaviours, and contexts that frame product use. We investigate how to empower the lead researcher to take a more active role in remote research, than is possible through contingent experience sampling methods and thing ethnography, by continuously observing live data and responding to moments of activity they would like to investigate through one-on-one interactions with participants.

This paper tests a method of combining sensor data with instant messaging in order to investigate the potential for live data to support design research. We test this method by carrying out a study on a series of Bluetooth speakers with embedded sensors and investigate the following questions:

1. Can sensor data be used to complement and support design research by aiding real-time contextual inquiry?
2. Can the data gathered from the sensors and participant-researcher interactions capture behaviours and attitudes that would be useful in the development of new design directions?
3. How do participants experience the data gathering process?

With this paper we contribute a novel method for remote design research that supports real-time contextual inquiry and a study testing that method. The method captures rich contexts of use and design insights. We further discuss considerations for the value, ethics, and future developments of the method.

## BACKGROUND

This research draws upon contemporary design ethnography and in the wild HCI research practices.

### Ethnographic Methods Utilising Remote Data Capture

While traditional ethnography *“is a methodology used to represent the perspective of everyday life”* in order to gain an empathetic perspective of a culture, design ethnography aims to gain rich insights into the lives of people with the intention to find design solutions that cater to their needs (Salvador, Bell, and Anderson 1999). Design ethnography gathers rich contextually grounded qualitative data, but requires immersion, fieldwork and observation, which are time and resource heavy. Digitally collected data is becoming an increasingly important aspect of research, with areas such as digital sociology illuminating many aspects of lived experience (Orton-Johnson and Prior 2013). As ethnographic practice shifts towards the digital, Julia Haines (2017) argues that a holistic picture can be gained through multidimensional ethnography, accounting for a *“variety of experiential spaces and how those spaces are integrated into the lives of those we study”*.

An exploration of non-human agency within ethnography reveals how smart objects and data can be brought in as co-ethnographers within research practices in various configurations. Object Oriented Ontology (OOO) is a philosophical movement developed by Graham Harman, where the word object is used to represent everything as a separate



independent but interdependent thing, including material things, individuals, and abstract notions. OOO accepts the inaccessible essence of objects (Harman 2016), and that objects are reducible to their interactions with other objects (Harman 2011; Harman 2012). To explore these notions further Ian Bogost (2012) developed *alien phenomenology*, a practice of exploring these object-centred perspectives through the use of metaphors. This inclusion of non-human things on an equal footing has prompted the development of remote ethnographic techniques centred on objects (Giaccardi 2016a). *Thing ethnography* offers a remote method to develop an in depth understanding of how objects are used in the wild, where embedded cameras and microphones allow things to act as co-ethnographers in a research process (Giaccardi 2016a; Giaccardi 2016b). Adopting a “thing perspective” can highlight new and surprising uses and relationships between people and things, but the process can be invasive due to the types of data that is gathered (Chang et al. 2017).

Similarly, *ethno mining* (Anderson et al. 2009) combines ethnography and data mining, putting quantitative data collected from sensors alongside qualitative data in order to develop an understanding that neither dataset can provide on its own (Aipperspach 2006; Churchill 2017). The method visualises sensor data post-hoc and uses it as a retrospective prompt for reflection and discussion in contextual inquiry interviews with participants (Aipperspach et al. 2006; Anderson et al. 2009; Bhavnani et al. 2017). Ethno-mining benefits from its unobtrusiveness, where the participant’s activities are not disrupted. However, the success of the method relies on the ability of the participant to recall past events and understand abstracted data, which may compromise the accuracy and detail of their interpretation (Freeman, Romney and Freeman 1987).

These contemporary ethnographic practices are exploring ways to conduct research remotely, allowing researchers to be co-present, rather than co-located (Anderson et al. 2009; Giaccardi 2016a; Giaccardi 2016b; Tallyn et al. 2018). They gather rich insights about human behaviour in the wild but are subject to several issues when collecting data about participant experiences. Ethno-mining and thing ethnography collect participant reflections outside the contexts that are being studied (Aipperspach et al. 2006; Churchill 2017; Giaccardi 2016a; Giaccardi 2016b; Hutchinson 2003; Odom et al. 2016). They often use interviews and participant feedback post-hoc, which affects recall, allowing participants to forget ephemeral reflections or be affected by the way data is presented (Gennip, Hoven and Markopoulos 201; Hoven 2015). To eliminate issues around retrospective recall Bhavnani et al. (2017), suggest using ethno-mining data to prompt experience sampling in real time.

While both of these methods require post-hoc analysis and interviews, the *Ethnobot* project (Tallyn et al. 2018) uses a real-time natural language generation algorithm to intervene in participant’s activities, simultaneously prompting actions and collecting data through WhatsApp messages. Tallyn et al. (2018) developed and deployed the Ethnobot within an ethnographic study where participants communicate with a chatbot to carry out real-time reporting of participant experiences. Framed around a live event, the Ethnobot app sent participants pre-set and open-ended prompts and was successful in capturing rich and informative contextually grounded data.

By reconfiguring the relationships between researchers, participants, and data-collection objects, these methods offer compelling new ways to gather ethnographic insights with the aid of ever smaller and cheaper sensors embedded within products. This led us to investigate how a combination of live data collected through smart products, and prompts sent to participants in response to this data, can be used in real-time contextual inquiry into situated

everyday life to support design led research, in line with the discussions raised by Bhavnani et al. (2017).

## In-Situ Research Methods

From HCI research methods, we primarily draw upon diary studies, experience sampling, and technology probes. We relate strongly to ‘in the wild’ methods, a diverse set of ways to collect, record and interpret data, driven by findings that in-situ participant experiences with technology vary from those recorded in a lab setting (Crabtree et al. 2013). *Research products* and *technology probes* explore the behaviours and attitudes of people around technology in the context of their everyday life (Hutchinson 2003; Odom et al. 2016). They are designed to be deployed into the wild in order to investigate a particular research question (Gorkovenko, Taylor and Rogers 2017; Odom et al. 2016; Tsai et al. 2014). Data about participant experiences are gathered from traditional interviews post-hoc (Gorkovenko, Taylor and Rogers 2017; Odom et al. 2016), and from the traces of use on the objects (Tsai et al. 2014). While data from the use of technology probes is used to elicit reflections from the participants after taking part in the study, diary studies and experience sampling benefit from contextually grounded data recording practices.

*Diary studies* give participants the flexibility to self-record their experiences and activities whenever it is suitable for them (Brown, Sellen and O’Hara 2000; Csikszentmihalyi, Rathunde and Whalen 1993; Müller et al. 2015; O’Hara and Perry 2001), while *experience sampling methods* (ESM) prompt participants to record their experiences at key times (Csikszentmihalyi, Rathunde and Whalen 1993). A challenge for both methods is that their self-reported nature may compromise the accuracy and detail of the data. In diary studies, participants often self-report when it is convenient for them, and this retrospective recall may lead to reflections going unreported (Gennip, Hoven and Markopoulos 2015). Data capture may help with this, for example Gouveia and Karapanos (2013) explored lifelogging as an alternative to self-reported entries, where the participants were asked to review daily collections of media. With this kind of large data collection, the way that the data is organised and presented to participants affects remembrance (Hoven 2015). This points to a need for developing research practices that utilise remote data capture in the service of contextually grounded participant reflections. One example of this is the Datawear app (Skatova et al. 2015), which captures data through a camera and elicits reflections on images through experience sampling on a mobile phone. Skatova et al. (2015) carefully navigate ethical ideas around private and public by developing a practice of self-reflection where all personal information is stored locally on the phone and only reflections generated by the participant are sent to the researcher.

Of particular importance to our work is *contingent experience sampling*, which furthers the methodological exploration of contextually capturing grounded experiences through the collection of thick data alongside sensor data and standardised survey responses (Berkel, Ferreira, and Kostakos 2017; Evans 2016; Smets and Lievens 2018; Zhang, Zhao, and Ventrella 2018). Here the sampling is initiated algorithmically based on a variety of factors, including completion events, change in sensor readings, events on the device, and events external to the device (Berkel, Ferreira, and Kostakos 2017). While these methods offer compelling new ways to gather ethnographic and design insights, they often take ethnographers out of the real-time research. Instead they enable engagement with

participants at a later stage of the process, often relying solely on data and algorithms to facilitate real-time feedback from participants. What remains, is to explore the potential to engage a human ethnographer in sensemaking and communication with participants live alongside data streams. In particular, our research contributes an understanding of where collaboration with algorithms is useful, and the configurations that best combine human and machine intelligence.

## METHOD

The method presented in this paper supports real-time contextual inquiry around the use of smart devices by combining live data with communication between researcher and participant. The aim of the method is to support the development of design insights around smart products through the combination of thick and big data. This method is hoped to benefit industry by supporting research that helps make human-centred products that cater to the needs of users. It aims to give participants agency over the research process by taking on an active role within live reflection and the creation of knowledge (Kennedy, Poell and Dijck 2015). Finally, the method puts the ethnographer in a central position during the research process, allowing them to decide when to initiate communication, and gather data in a remote but co-present manner.

The method builds upon developments within contingent experience sampling, thing ethnography, ethno-mining, and Ethnobot. Similarly to thing ethnography it utilises objects as co-ethnographers, but avoids the use of cameras, microphones and GPS trackers in order to limit invasiveness. The method utilises an ethno-mining approach to collecting data throughout the research process, but in order to limit retrospective recall issues reflections about the data are prompted both close to the time of activity and in a post-interview. Like Ethnobot we use instant messaging to collect live reflections from participants in the contexts that are being studied, but that communication is prompted by live data. Finally, communication is triggered by activity, like contingent ESM, but the triggers can change and adapt to the developing questions of the lead researcher, and communication can be free-flowing and nuanced rather than based on pre-defined structured questions.

The process is as follows:

1. An existing object is augmented with sensors. In order to both support the development of ethical research practices and minimise effects on participant behaviour we avoid collecting video, audio, and GPS data.
2. Sensorized objects are then deployed in the wild where they are used by participants in the real life context that we expect to see the products.
3. The objects stream live data to a specialised tool used by the research team, which visualises the data.
4. Ethnographers monitor the data stream in order to spot moments of interest to probe and investigate. This process can be aided and supported by algorithms that alert the lead researcher when certain types of activity is seen within the live data. Throughout the study the sphere of interest would change and develop to reflect the development of a nuanced understanding of activity.
5. Interactions with participants are initiated by the lead researcher. The researcher has agency over the process and may choose to probe moments of interesting activity

observed within the data streams, in line with contingent experience sampling, or investigate the behaviours and motivations that frame activity more generally. Currently participants are contacted using instant messaging (IM), where a free-flowing communication can occur on a familiar platform. Participants are also encouraged to capture and share photos or videos of the object, which aids contextual inquiry.

6. The sensor data and IM data are combined to build up a rich picture of the ways that participants interact with the objects.
7. The data collected throughout the study, including communication, sensor data, and photos and images, is collected and used in a post-interview with each participant.

## STUDY

In order to test the applicability of the method on developing design insights and an understanding of smart product use, we developed a collection of portable Bluetooth speakers containing sensors, to act as technology probes (Hutchinson, 2003). We chose to create portable speakers for various reasons, including ease of manufacture, and their potential to be used in a variety of contexts and with a variety of intents. We were particularly interested in how the use of the devices differed from participant to participant and if those differences led to varying design insights. The speakers streamed their orientation, acceleration, playback state, and currently playing track (Figure 1). Participants ( $n=13$ ) were asked to take one of our speakers into their homes and use it for a duration of 10 days. They were asked to use it every day, for as long as they liked, and respond to the prompts that we sent to them via WhatsApp.

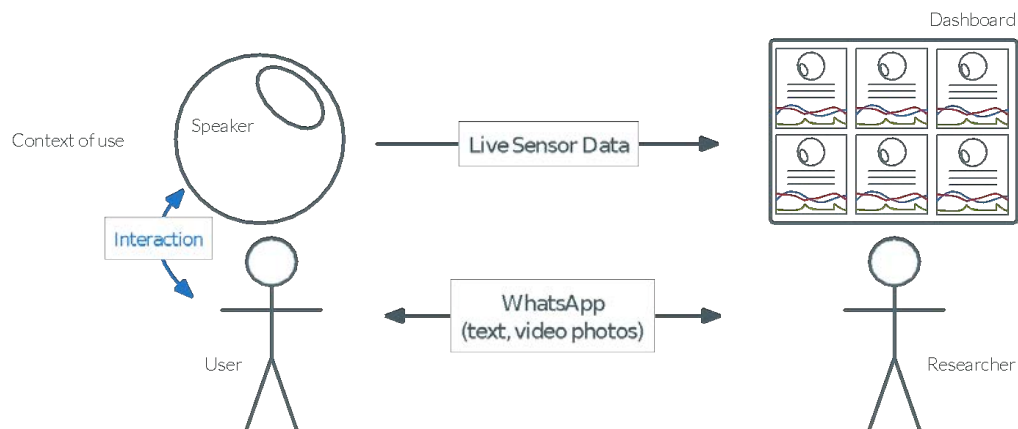


Figure 1. System overview, showing data flows between researchers and participants.

The data from the speakers was monitored using a custom-built dashboard. It utilised a series of digital representations of the speakers with their associated data, developed by Burnett et al. (2019). Whenever the participants used or handled the speaker they were asked questions specific to the data we observed. In times of no activity they were sent general

prompts and questions about the study experience and their use of the speaker. The dashboard was continuously monitored from 10 AM until 10 PM daily for movement and audio data, and all communication was carried out by the lead researcher. Although the dashboard was monitored for long durations of time, the daily interactions of each participant with the lead researcher tended to be short. As a rough approximation, most participants took around 5 minutes per day, with a minimum of 2 minutes and a maximum of 34 minutes.

## Bluetooth Speakers



Figure 2. Three speaker designs. Left: cube with button controls; centre: sphere; right: cube with gesture controls.

The speakers are technology probes designed to investigate the potential of sensor data to support remote design research (Hutchinson, 2003). They worked as conventional Bluetooth speakers, playing any audio from a connected device. We created three different designs in order to examine how the design of the speakers affect how they are used (Figure 2): i) laser-cut acrylic cubes with volume and track control buttons; ii) 3D printed white spherical speakers with no controls; iii) acrylic cubes that responded to gestural controls, e.g. tipping forward to increase the volume. None of the speakers had an on or off switch, in order to continuously receive data. Inside they contained two paper cone drivers, a RaspberryPi ZeroW, and a 9-Degrees of Freedom, Inertial Measurement Unit (IMU) board, which measured the object's orientation, movement, and acceleration, updating every 100ms. The speakers used WiFi to stream sensor data, archiving it for later transmission when no WiFi was available. The data was displayed on a bespoke dashboard containing a simple virtual representation of each device, which displays its spatial orientation, alongside sensor and playback data (Figure 3).

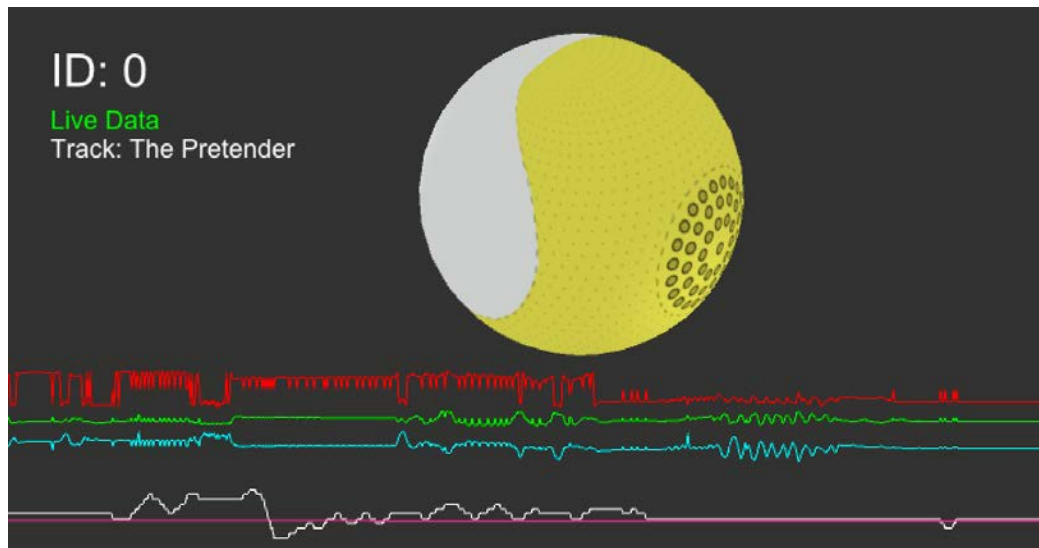


Figure 3. Example of a digital twin of a spherical speaker as displayed within the dashboard, showing a 3D model of the sphere, orientation on 3 axes (red, green, blue), playback volume (white) along with the current track.

## WhatsApp Interactions

The researcher used the dashboard to gain a real-time view of how the speakers were being used, informing communication and prompts with the participants through a dedicated project WhatsApp account. At regular intervals and also when something interesting occurred the participants were sent prompts. They each received between two and three prompts per day. The prompts could result in a short conversation or request for a photo or video. When the researcher observed activity on the dashboard, such as playing music, movement and changing volume, the participants were sent specific prompts relating to the data. Data responsive prompts usually contained some information about the data that was coming in, for example: *"I can see that the speaker moved. What did you do with it?"* or *"I can see that you have been playing an audio file but there is no metadata, what have you been listening to?"*. The rest of the prompts asked general questions about the experience, such as *"Have you tried using the speaker for anything other than music?"*. The prompts included an array of questions aimed to probe how the participants felt about using the speaker, where they used it, what activities they used it for, what else they did while they were using the speaker, and how they felt about the research process. These exchanges aimed to elucidate the context, behaviours, and motivations framing moments of engagement.

## Participants, Data Collection and Analysis

The study was carried out with 13 participants, for 10 days each. Eight of them were female and five male. The majority of participants (N=11) were recruited through university emailing lists and included a combination of undergraduate (N=1), masters level (N= 5) and PhD (N=3) students, as well as university staff (N=2). Another two participants were

recruited through word of mouth. Before the study, each participant carried out a pre-interview (5-15 minutes) and consent process, with a longer (20-60 minute) semi-structured interview at the end. The participant's audio listening habits varied, but all reported they listen to music, video, audiobooks, or radio, on a daily basis and felt they could incorporate using our Bluetooth speakers into their pre-existing listening habits.

For each participant we collected:

- **Sensor Data:** 3D accelerometer, magnetometer and gyroscope data.
- **Audio data:** track, artist, and album names; control events – track skip/rewind, playing/paused status; volume changes.
- **WhatsApp data:** text logs along with photos and videos.
- **Pre/post interviews:** audio recordings with anonymised transcription.

All data collected on the devices was time-stamped, with a flag to indicate whether it streamed live or stored and streamed later if the device was out of WiFi range.

A thematic analysis (Braun and Clarke 2006) of the interviews, WhatsApp interactions, photos, and videos was conducted using Nvivo. The data was coded using the software by the lead researcher. It was then refined and clustered into themes by two of the researchers until the final themes were agreed upon.

## RESULTS

The study resulted in 380 WhatsApp prompts in total, of which 63 were sent in response to activity observed on the Dashboard. Below we outline the three major themes that emerged from the WhatsApp interactions and the interviews: uses, design opportunities, and reflections on participation. The first two themes relate to the experience of the participants in relation to the speakers, while the last theme relates to the participants' self-reported experience of the process. Throughout the results, we present quotes and summaries extracted from the qualitative data, supported by quantitative data visualisations where appropriate. Quotes with timestamps in the form of [hh:mm:ss] are taken from WhatsApp chat logs; those without are from post interviews.

### Uses

Continuous communication with the participants revealed how, where and why they used their speakers throughout the duration of the study. The interactions that were prompted by activity seen on the dashboard, largely related to movement, such as when the speaker was picked up. Most participants kept the devices in their homes, with only P9 taking his to work to listen to music and P3, who had a spherical speaker, taking his to the park to juggle with.

Most of the participants described using the speakers for listening to music in the background of other activities, commonly alongside getting ready in the morning, cooking, working, and doing chores. They also described listening to podcasts, news and audiobooks. A combination of metadata and conversation revealed a range of devices connected to the speakers including smartphones, tablets and laptops. Similarly, the participants reported

using 9 different applications, including Spotify, iTunes, and Netflix, with metadata giving clues and opportunities for discussion:

<[19:53:39] Researcher: I can see that you have been playing an audio file but there is no metadata, what have you been listening to?

[19:54:20] P11: I've been streaming Chinese songs on Apple Music>

While all participants listened to audio on a daily or near daily basis, only P1, P5 and P8 owned Bluetooth speakers and could build on existing habits:

P1: "... I use one all the time in my personal space ... I didn't feel like I had to adopt a habit around a speaker, because I already had one."

Some participants had regular patterns of use, such as P1, who (with two exceptions) used her speaker daily in the late morning, while others (e.g. P9) had less structured timings (Figure 4).

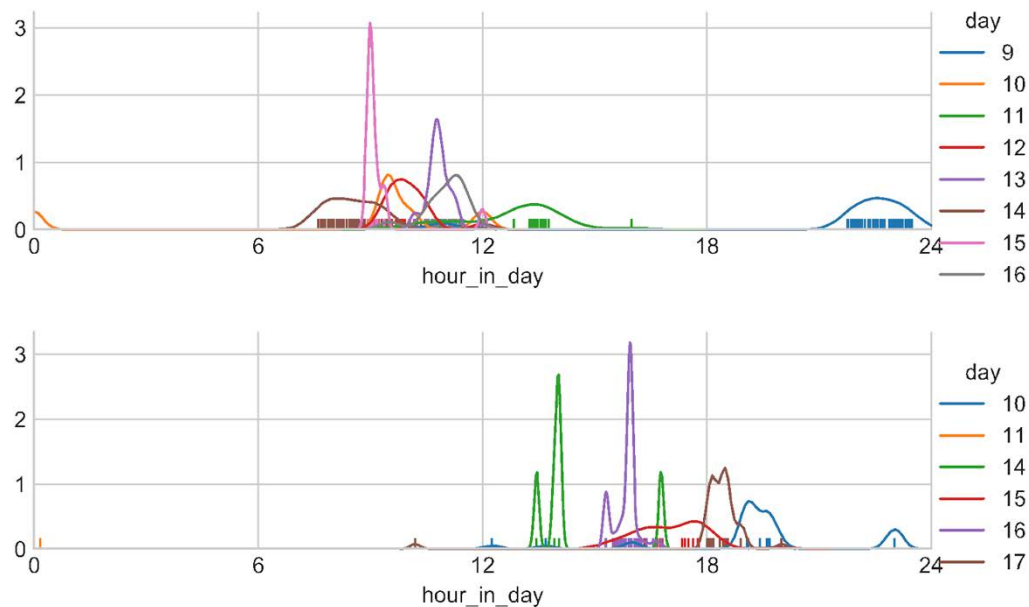


Figure 4. Daily habits of P1(top) and P9 (bottom), showing activity (track changes, playback start/stop) with lines illustrating periods of maximum activity. Each color represents a different date within the study.

The portability of the speaker encouraged movement to complement situated activities. For example, P7 used the speaker in five different locations around his living space. These included i) the living room while working ii) the kitchen table while eating iii) the bathroom



while shaving and iv) the bedroom while doing chores. These movements were captured through live data, supplemented by requested photos (Figure 5).

<[10:21:28] Researcher: Hi the data shows that you moved the speaker. What did you do with it?

[11:14:23] P7: I moved it to my bedroom as I was doing chores there and used it to listen to music>

In the final interview P7 reflected on how portability allowed new habits to form: “It was connected to my phone, I just moved the speaker. I think it improved my listening to things in other rooms a lot”.



Figure 5 Speaker usage in the wild with P7, showing its use while working (left), alongside bedroom chores (centre) and while eating dinner (right). All images taken by participant and used with permission.

In contrast, although P4 played music in the mornings as she would normally do with her phone, she never moved the speaker, preferring to leave it static. This was due to her small student accommodation living space. Gaps in the data stream could indicate use and location, when supported by WhatsApp communication. For example, P9’s speaker disappeared every morning after a burst of movement. Questioning around these disappearances established that P9, who manages a small art gallery, took the device to work, where it could not send live data. The speaker was used as the primary gallery audio throughout the work day, and photos collected showed that it was located either on the counter where it was charged or on a shelf where it could be better heard by customers. When the device showed up playing music through the day, the researcher could deduce that P9 had a day off.

## Design Opportunities

The WhatsApp interactions aimed to explore design opportunities for the speakers by investigating the ways they meet the needs of the participants, and the ways they do not. One issue was battery life, with many participants resenting having to charge the devices each day. This resulted in multiple requests for a power switch:

P10: “that’s the thing that annoyed me a bit, that it didn’t have an on and off button, because I don’t like to leave stuff connected all during the night.”

All of the participants complained about the sound quality of the speakers. This prompted some to use the speaker for audiobooks and podcasts instead of music (P4, P6, P12), or deterred them from using it (P3). While P11 thought it sounded like a budget speaker. They reflected that although listening to Western songs with the speaker was unsatisfying, it may have sounded better with Chinese songs due to the phonetic differences between the languages.

P11: “I have been tending to listen more to Chinese songs during the study, and I realised that for some particular Chinese songs, it actually sounds better on this than the other expensive speakers.”

The three different types of speakers encouraged slightly different ways of interacting with the objects. The spheres, used by P2, P3, P5, and P12, were seen as playful and robust, and often sparked the imagination of the participants. They all enjoyed aspects of the shape, colour and materials of the speaker, P5 described how it gave her a “pleasant and calming feeling”. Some participants explored alternate uses for the speaker like P3 who experimented with using the spherical device for contact juggling, suggesting that it needs to be slightly smaller and lighter, but that the shape is extremely beneficial for performances. Meanwhile, P2 saw the speaker as “a lazy cat”:

P2: “Reminds me a bit of my record player - it's like having another sentient being in the flat. It plays the music but also feels like it simultaneously provides a form of company while you then listen to it.”

While pleasing, the spherical design was somewhat awkward. A conversation prompted by movement revealed that P5 had moved the speaker to the kitchen where she was making dinner and sent a video of it wedged behind the kettle in order to balance it (See Figure 6, left). In the final interview she reflected that if it was made out of more rubbery material it would be easier to balance.

In contrast, the cube shaped devices were often perceived as fragile, which affected how they were used. This was partly due to the construction, which made the participants feel as if “*the walls could fall apart*” (P1) and partly due to a transparent panel making the internals visible:

P8: “I was a little scared of breaking it, just because, you know, I guess, when you can see the insides of something, you’re like, “Oh, it might be more delicate.”

The speakers did in fact fall apart on several occasions. The process of communicating throughout the study helped us identify issues in real-time, and support the participants in fixing them. P9 who took the speaker to work using his backpack every day broke his speaker twice, once in his bag, and then again in the shop by accidentally pushing it off the counter (See Figure 6, right). Several other issues occurred requiring resets and rebuilding: the speakers belonging to P7, P4 and P6 stopped working, P9 and P3 dealt with various volume and Bluetooth connectivity issues, and P7 had to reconstruct his speaker when it fell apart in his hands. Participants who reconstructed and explored the speakers reported that they felt more attached to them as a result of the experience (P6, P9).



Figure 6 Strategies for working with the speakers. Preventing rolling by wedging with a kettle (left), annotating with gesture commands (centre), speaker accidentally broken by a participant (right). All images taken by participants and used with permission.

The cube-shaped speakers could either be controlled through buttons, belonging to P1, P8, P10, P9, and P11, or by tipping and twisting the speaker itself, belonging to P4, P6, P7, P13. The buttons on the speakers were seen as too stiff or too small (P9, P10). P11 simply ignored them preferring to use his phone to control playback. While P1 felt that the buttons were especially useful when she was in the bathroom and did not want to get her phone wet.

The gesture sensitive cubes received a mixed reaction. P7 enjoyed being able to control the speaker by manipulating it physically and described leaving his phone in a single location while taking the speaker around his home. P4 and P6 found that the interactions were too sensitive, activating when the speaker was relocated. There were no visual indication for the direction of controls, and P6 found it hard to associate gestures with the position of the cube. The repeated attempts at gestures showed up on the live sensor data, and in the ensuing WhatsApp conversation, we discovered that she was addressing the problem by adding her own annotations to the device (see Figure 6, centre):

<[19:34:37] Researcher: I can see you are moving the speaker. Are you relocating it to the bathroom now?

[19:36:09] P6: Nope. I'm trying to use it to control the music I want to play

... [19:36:49] Researcher: Did it work?

[19:37:04] P6: Not so well.

... [19:47:51] P6: I made signs on the Object to indicate the interactions.>

The transparent panel on the cubes allowed participants insight into the device's internal states—lights on the battery pack helped P1, P6, P9 and P13 understand charge, and a blinking blue light from the WiFi dongle revealed when data was being sent. P9, who accidentally broke his speaker twice, used the lights to aid reassembly:

P9: "Every time you put it back together, you're looking for all the lights. You're like, "Okay. There's the power pack light. Where's the green light flashing? Where's the blue light? Why isn't the blue light happening?" It's quite fun."

Finally, the speakers we collected at the end of the study contained multiple traces of use. Some of them indicated issues with the design, such as the labels made by P6 and a multitude of broken spring clips, while P9's was decorated with an intricate pattern, indicating how he personalised and took ownership of the speaker.

## Reflections on Participation

The participants' perceptions of the experience of taking part in the study varied depending on how comfortable they felt with the lead researcher monitoring the data coming in, how they viewed the WhatsApp interactions, and to what extent they found the speaker useful. Some participants (P1, P7, P8, and P10) felt that they used the speaker based on their pre-existing listening habits, and did not find the WhatsApp prompts disruptive or the study invasive. Others were affected by the feeling of being observed and were mindful of how they used the speaker. Six of the participants described listening to more music than usual at the start of the study. Beyond our stipulation that they use it daily, some participants described consciously trying to provide us with as much data as possible:

P13: "first few days, I was more conscious of trying to use it a lot, and then the other days, I was just using it when I would normally have music on"

Others imagined that the lead researcher would listen in on what they played through the speakers. P2, P6 and P9 even found themselves feeling like they were creating a playlist for the lead researcher. They reflected on their listening habits, what aspect of their identity they were presenting through their playlists, and what could be inferred about their emotional state. P2 and P9 felt compelled to not listen to songs on repeat, and P2 reported that he enjoyed exploring his Amazon Music collection in a new way.

P2: “I probably have thought somewhat more about variety of selection than I might otherwise have done. I just played that, so let's now have something different’: it's almost as if I convince myself that those capturing the data are in effect also listening to the music themselves.”

Asking questions based on live data was sometimes reported as invasive due to the connection to activity:

<[15:03:51] P4: It's not too bad, at times I find it invasive because I'm being asked what I'm doing even though my movements are not being tracked by the device>

While seen as invasive, the WhatsApp interactions also helped the participants whenever issues occurred with the speakers. P6 who's speaker was connected to her phone via Bluetooth but did not play music, reported her issue to the lead researcher. Based on the researcher's suggestion she opened and rebooted the device, which fixed the issue (Figure 7).

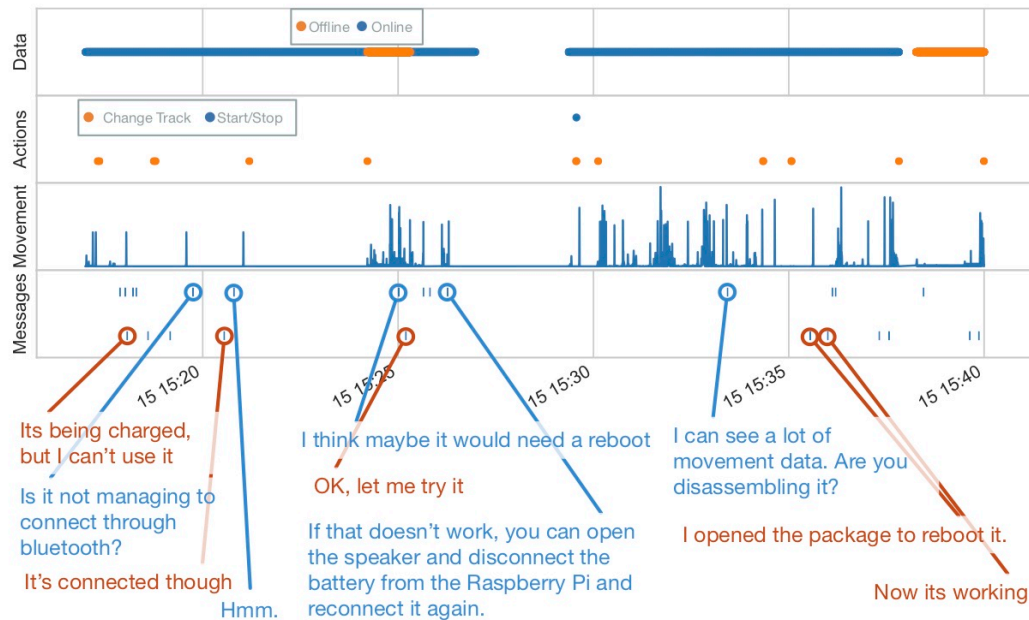


Figure 7 Annotated graph of interaction with P6 around fixing and rebooting their speaker.

Some participants (P5, P6) felt stress about complying with the study demands, which contributed to a somewhat negative experience. P6 worried about forgetting aspects of her experience, striving to provide us with “*immediate feedback, which [she thought] is more reflective and more detailed*”. In some cases, participants avoided using the speaker as they knew they would be messaged, e.g. P5 did not use the speaker when her friends were round, as she did not want to respond to messages. P5 also reported towards the end of the study that she had a nightmare, where she had received a photo of herself through WhatsApp that was taken from the perspective of the speaker.

In light of the discomfort some participants experienced, we asked them how we could have made the process less intrusive. There was a consensus that the real-time questions were necessary in order to get an accurate understanding of how the speakers were used. P5 felt that having a bot carrying out the WhatsApp interactions may make the process less emotionally taxing, while P2 felt that communicating with the lead researcher was more personal and less disturbing than with a bot or machine:

P2: “There was a face I could put to it. I felt more that you were enquiring. I think if it had all been automated I would have felt that something or someone was observing in the much more loaded, negative sense.”

Finally, several participants (P1, P4, P7, P13) felt that taking part in academic rather than industry research made them more trusting and forgiving of the inconveniences of the process.

## DISCUSSION

The method we present draws from ethnographic and experience sampling methods where things act as co-ethnographers, the possibility of real-time responses to data, and the algorithmic processing of data streams to generate insight. Within the results, we explored how live sensor data prompted exchanges with participants about the contexts in which they were using devices in the wild. Here we will discuss how this method revealed rich contexts of use, highlighted design opportunities, and the experiences of participants. We further discuss how we would develop this method further.

### Value of Method

RQ1 Can sensor data be used to complement and support design research by aiding real-time contextual inquiry?

#### *Contextual inquiry*

From the point of view of contextual inquiry, being able to interact with the participants directly resulted in a collection of photographs and videos of devices in use. From Figures 5 and 6 we can see a range of domestic situations, with the devices part of the landscape, rather than being posed performatively. The value of immediate communication was particularly apparent in the interaction with P5, where motion data triggered a conversation that resulted in a video of the speaker wedged between a kettle and a drying rack. This was somewhat unconscious, and not reported in text, but was captured by a video requested in response to data. The ability of the lead researcher to dynamically engage with participants helped reveal this unreported behaviour, which may have been missed by contingent experience sampling.

Where past research has identified that experience sampling, and diary studies can miss details of the contexts that are being explored (Csikszentmihalyi, Rathunde and Whalen 1993; Gennip, Hoven and Markopoulos 2015; Hoven 2015), this method facilitates communication close to the time when the activity is occurring. We are interrupting people's

activities and prompting reflection in the moment, trading off between participants' ability to recall and the intrusiveness of being asked about what you are doing. The method borrows strategies adopted by contemporary design ethnography, including ethno-mining where data is used as a discussion point in participant interviews (Aipperspach et al 2006; Churchill 2017), Thing Ethnography where sensors are attached onto a product turning them into co-ethnographers (Giaccardi 2016a; Giaccardi 2016b), and the Ethnobot tool where live communication with a participant is facilitated throughout the duration of the study (Tallyn et al. 2018). Combining these strategies allows us to tailor prompts sent to the participants based on the incoming live data, which allows us to investigate the contexts, behaviours, and motivations that frame the use of the speakers. Through a combination of reacting to participant activity and semi-regular sampling we gained a comprehensive picture of how the device fits into the user's habitus.

### *Emerging behaviours*

The devices that we deployed were idiosyncratic, and as such, the study revealed several strategies that the participants adopted to deal with the slightly unwieldy devices, such as P6 placing signs on her speaker. The ability to rapidly spot new behaviours allowed us to see the very first steps that users took to overcome problems, developing a temporally situated view of their process.

From a research point of view, this is somewhat challenging, as the discussion affected the participants behaviours. However, from a design and development perspective, it allowed us to reassure the participants about modifying the devices, offer problem solving advice, and identify design opportunities.

### *Ground truthing sensor data*

While the WhatsApp communication, including texts, images and video, gave us an opportunity to discuss the contexts of use and the participants reflections, the live data allowed us to see patterns of behaviour emerging. By combining these two data sources, we were able to 'ground truth' the sensor data against reported activity. A key example is when the volume setting on P1's speaker repeatedly jumped between two different levels. By prompting for a discussion about this, we learned that we observed these volume jumps when they switched the audio source from their iPad to their phone, which had the volume output set at different levels. This would lead naturally to an understanding of when and how participants use different devices with the speakers. Similarly, we could see periods of movement, coupled with the device going offline shortly after – conversation with participants indicated they carried the speaker in a bag to work. Through this combination of big and thick data the lead researcher was able to gradually build an understanding of the live-stream, developing more nuanced questions as the study progressed.

By adopting a thing perspective through a research process centred around sensor data emitted by the object and conversations emerging in response to this data, we developed an understanding of the relationships that developed between the technology probes and the participants. Where ethno-mining attaches meaning to data post-hoc allowing for misinterpretations on the part of participants (Aipperspach et al. 2006; Churchill 2017)

questioning participants close to the time of activity allowed us to ground truth our understanding of the sensor data.

#### *Co-creativity and instant reporting*

A side effect of our frequent interactions with the participants is that it gives them the opportunity to become collaborators in the understanding and development of products. This is an effect that has not been explicitly stated or observed within the research methods we build upon. After some prompts, several participants became keen to send in photos of the ways that their speakers had gone wrong, or had been personalised, becoming proactive in their reporting. This shifted the relationship between participants, the researchers, and the devices. In most cases, it opened up spaces for discussion and experimentation, in particular allowing us to reassure participants that repairing or altering the speakers was allowed. In one particular case (P1), the participant grew to expect responses from the researcher every time they used the speaker, and noticed times when there was a lack of prompts. The overall effect was to give participants greater agency over design process, building on their reflections and enlisting them in carrying out sensemaking around their experience (Mols, Hoven and Eggen 2016). We could capture insights as they happened, and interactively investigate them, rather than relying on retrospective recall. This shift in dynamics allowed participants to change the flow of information from themselves to the research team, accessing information and assurances as they need them. By leveraging reciprocity and communication within the research process, participants can become personally invested in the process.

### **Relating to Design**

RQ2 Can the data gathered from the sensors and participant-researcher interactions capture behaviours and attitudes that would be useful in the development of new design directions?

#### *Capturing user improvements*

The WhatsApp communication revealed user's ad-hoc improvements, suggesting ways that the speakers could better address the needs of the participants—for example P6 adding labels to their speaker. The significance here is that the user innovation required to temporarily resolve this issue was not apparent in the real-time data stream, and could have easily been missed without time consuming post-study interviews. The ability to capture user improvements, product hacks and suggestions via real-time communication may provide significant value in accelerating product innovation. This occurred in the context of quite shallow relations between the researcher and the data stream – with a more developed data processing system, conversational triggers could be targeted, based on inferred novelty.

Opening up communication between industry and consumers may extend the lifecycle and desirability of products. It is estimated 78% of products are still functional when disposed of (Ceschin and Gaziulusoy 2016). By identifying easily fixed faults and providing remote troubleshooting and directions for repair by users, we can prevent premature disposal of products. However, it will also be possible to evaluate user interactions during



these periods and use the insights to make subsequent product iterations easier to fix by re-design of parts.

#### *Data driven design*

Various studies have demonstrated the power of combining product simulation with generative techniques to discover new design solutions (Matejka et al. 2018). However, a key limitation of these works is that the quality of the solution is closely related to the quality, accuracy and speed of the simulation method. The approach outlined in this study could open up new possibilities of performing large-scale A/B testing and product evolution in relation to real-world usage insights.

Within this study the attributes of the dashboard drove the researcher-user interactions. Specifically, the dashboard provided detailed data associated with speaker movement, which became the main identifier for novel user behaviours. A significant area for further investigation is to explore how to best visualise and interact with product data across different needs and disciplines, e.g. designers, engineers, and end users (Mortier et al. 2015). The use of machine learning has the potential to categorise and identify patterns within the data and identify novel and unexpected behaviours. We further suggest a participatory approach for the creation of dashboards with designers in order to target features of relevance and interest.

### **Data Gathering and Participant Experiences**

RQ3 How do participants experience the data gathering process?

One major area of concern is that the process was invasive – participants became used to being questioned after every movement or interaction with the devices. If this was positioned as a pure ethnographic method, the level of disturbance could be problematic. While some level of disturbance is warranted (Crabtree et al. 2013), particularly as it engages the user with the design process, a longer-term study, with a lower frequency of interaction is clearly of interest.

A crucial part of collecting data in the wild is dealing with the ethical issues framing the experiences of participants. The invasiveness of the study, their level of comfort, and their willingness to engage are affected by the research process. Situated data gathering in particular tends to become both personally identifying and intimate (Canzian and Musolesi 2015; Montjoye et al 2013). This affected our choice of sensors; where previous Thing Ethnography and experience sampling work used broad data capture devices such as cameras and microphones (Chang et al. 2017; Giaccardi 2016a; Giaccardi 2016b; Skatova et al. 2015), we used sensors that were minimally identifying. Furthermore, understanding how that data can benefit and create value for industry raises questions about consumer exploitation, as raised by Zuboff (2015). It is thus imperative to give greater agency over the research process and data collection to participants. Here participant agency could take on a multitude of different processes that shift power from the researcher and manufacturer to the participants, primarily in understanding the data streams they generate and in being able to control them (Kennedy, Poell and Dijck 2015). One way explored by the HCI community is to store raw data locally and to give users the ability to only share reflections or the results

of algorithmic processing (Crabtree et al. 2018; Skatova et al. 2015). For the purposes of our method, only sharing reflections as initiated by the participant diminishes co-creativity and the ability of the researcher to identify moments of interest and engage in conversation alongside those moments. Instead we view an opportunity to explore how participants can be given greater agency over who sees their data, how it is used and analysed, how it is understood by researchers.

Some participants reported that they were not influenced by the data gathering, while others experienced stress. A similar variety of reported participant experiences regarding ideas of privacy were also observed within a study by Oulasvirta et al. (2012) where a surveillance system was installed in the homes of 10 participants for the duration of a year. The discomfort around data collection in pervasive surveillance diminished with time even in those negatively disposed towards being continuously monitored (Oulasvirta et al. 2012). While a longer deployment of our study may have resulted in a similar plateau of relative comfort with the data collection process, the continuous use of messaging prompts and interaction with a present researcher may affect the participant's ability to ignore the data-collection.

Issues remain around consent—in particular, when objects exist in shared spaces, it is impossible to gain informed consent from every visitor to the space. This is somewhat ameliorated as we are not able to immediately identify a portion of the data stream as being due to the actions of a particular person. We believe that a split we make here can prove a useful model for data gathering in a more humane manner: *passive capture vs active report*. Passive data collection should be minimally invasive, aiming to capture information about the device, rather than the user. In contrast, identifiable, personal capture should be carried out actively, giving the user an understanding of the process, and offering opportunities for explanation and collaboration around the way that the data is interpreted. This develops the idea that ethical practices can lead to better results, as users are happier to share and researchers or developers can reduce the sense of data colonialism (Thatcher, O'Sullivan and Mahmoudi 2015).

Going beyond the capture, we need to understand what can be inferred from the data, and how participants could possibly consent to this. Some participants altered their song choices to avoid disclosing their emotional state to the researcher (in Reflections on participation), but it is extremely plausible that these sensorised devices start becoming more emotionally acute, especially when working with longitudinal data. Users are often unsure of what is being collected at a basic level (Makinen 2016), although they may often willingly participate in surveillance (Ellerbrok 2010), often with incorrect mental models of what can be inferred from the data (Rader, 2014). With respect to music listening habits, the sharing of music being played forms a part of identity management (or profile work (Silfverberg, Liikkanen and Lampinen 2011)), so it is not surprising that some participants were concerned about this. These all raise the issue of contextual integrity (Nissenbaum 2004) as a crucial determinant – how does the use of the data captured relate to the context within which it was captured. Where participants were able to engage with the research, they could gain reassurance about what was being collected, but for longer deployments, or for products with users as opposed to studies with participants, more participatory approaches would be useful – helping users understand what is being learnt from their data.

## Agency within the Research Process

When examining the agency of the participants, researchers, sensorized speakers, and the data visualization tool, we see how their interconnected roles shape each other's actions. A more speculative examination of this can be found within our future-oriented theoretical paper on *Entangled Ethnography* (Murray-Rust et al. 2019). In this study, the ethnographer interprets live data streams, facilitated by the dashboard and sensors, and gradually builds an understanding of the participant's habits and feedback. Throughout this process they have control over initiating interactions with the participants and probing their motivations and conceptualisations. Researchers are both influenced and confined by the types of data collected and the way the data is visualised – one result of this can be seen in the large proportion of prompts which were associated with movement, as this was the most immediately visible aspect of the data. If the visualisation system developed further, more types of data would become at-hand, and able to shape the practices of the researchers. Similarly, the live view of the data was dependant on the speakers being connected to the participant's WiFi. Due to these infrastructural concerns, attention and hence insight was focussed on indoor interactions, with insight about the use of the speakers outdoors limited to information the participants were willing and able to share without the interactions being grounded in the data.

The speakers and dashboard act as independent facilitators in the creation of knowledge, despite their agency being limited to responding to manipulation by the participants. The participants had control over the use of the speakers, the amount of information they were willing to share, the types of data they sent (e.g. photos, video, text), and the times they wished to respond. However, as the study progressed they also became more strategic about when and how they used the speakers themselves in order to affect when they received a prompt. These behavioural developments indicate that the participants understand and appreciate their power to regulate the pace of disruption within the research process. We argue that giving over agency to the participants about the interpretation and collection of data, beyond simply giving them the ability to stop taking part altogether and withdraw the data that is being collected on them, may help participants feel in control. We also saw the participants and researcher having a greater ability to actively engage and question each other throughout the study, where the speakers became objects that could be used conventionally to play music, but also be fixed, hacked, labelled, drawn on, and physically manipulated.

This distribution of agency between the actors involved in the research process counters the negative narrative discussed by Zuboff (2015). In contrast to thing ethnography and ethno-mining, the participants had greater control over the interpretation of the data by the researcher as the study progressed, rather than providing a retrospective reflection on the meaning of data. While ethnobot and contingent ESM do facilitate a similar level of live reflection, the research process presented here, allowed for more fluid two-way interaction, which led to the development of behaviours unrecorded by the other methods, specifically researcher-supported troubleshooting.

Looking towards the future use of this method, we feel that computational algorithms, which look for indicators within the data, such as threshold detection or activity recognition, might help initiate interactions with participants. Such a development would be necessary for the scaling up of the method as discussed in the following section. These interactions can take the form of traditional ESM style questions tailored to the trigger observed within the

data, or even through a chatbot-interface. This would reduce the burden on the lead researcher who might choose to monitor the live data stream only at key times and with a pre-defined research question in mind. Conversely, it would increase the agency of the data collection and visualisation system, affecting the ability of both the researcher and participant to take part in active sense-making around the data. This opens the question of how ethnographers and other researchers mediate between algorithmic triggers or analyses and personal interactions with participants.

## Developing the Method and Scaling Up

Having shown that this method is capable of collecting rich data, would it be possible to carry out studies that are several orders of magnitude larger, and what would be involved in doing so? The study has been set up somewhat as a wizard-of-Oz version of a fully automated potential experiment. As such, the researcher's task can be broken into three separate components: deciding when to initiate a dialogue, carrying out the dialogue, and interpreting the results. We discuss how this method could be scaled up and how it may be used within an industrial context by identifying the sites where collaboration with algorithms is useful, and the configurations that best combine human and machine intelligence. It is important to emphasise that we see this method as an ever-evolving and iterative process, where a researcher would take an active role in personal communication at key times, but who would also be able to set contingent experience sampling triggers throughout the process as they try to understand the behaviour of participants. As such the role of the ethnographer cannot be replaced by algorithms that trigger interactions, instead they would be actively engaged in calibrating and defining their function.

Within this study, the researcher started conversations in response to most observed activities. This was found by some participants to be intrusive, and shaped the behaviours of others (in Reflections on participation). A machine learning approach could use a combination of *activity recognition* (Bao and Intille 2004; Tapia, Intille and Larson 2004) and *novelty detection* (Markou and Singh 2003) to discount commonplace occurrences and manage the frequency of interactions to make best use of the attention of both researchers and participants. This would also have a positive effect for the time needed to monitor the data dashboard. The participants usually used their speakers once a day at key times, such as when getting ready or doing chores, the rest of the time the dashboard did not indicate any activity. Even basic automation such as alerts when there is a change in the data would increase the ratio of interesting interactions and decrease the need for continuous monitoring of the data, making it more plausible to carry out long term, large scale studies.

Making sense of the data is another area where machine learning could quickly support human activity. Raw sensor data is messy and multidimensional, and much of the analysis of habits here was carried out post-hoc. An ability to classify behaviours would direct human attention to a small set of truly interesting moments, focusing sensemaking efforts on the richest resources. These new behaviours could then be more painstakingly contextualised, and their data signatures added to models of activity to spot larger scale patterns.

Conducting the dialogue is somewhat more challenging. While the Ethnobot study (Tallyn et al. 2018) paves the way for new research practices, it remains to be seen how complex a dialogue system is necessary to reproduce a reasonable level of contextual inquiry.

The current study tended towards relatively simple interactions – a well-chosen question and one or two follow up responses in most cases.

There is a question about generalisability. To test our developing method, we worked with Bluetooth speakers as objects that appeared in everyday social situations, with a good likelihood of being used in multiple locations and which were easy to make part of daily life. We were also bound by needing a device that would be regularly recharged and could house a battery and microprocessor. While there are many other devices that fit this criterion, application to different areas will still require some thought and customisation, both to the method and the devices.

Sensorizing objects and conducting research around them is costly in terms of resources and time. As technologies develop, however, we envision that this method could be used by design researchers and industrial product designers in contexts where many existing devices become potential research products (Odom et al. 2016). We believe the method would be appropriate alongside products that are perceived to have high value, have complex functionality, or where the data collection process is interlinked with the function of the device, such as autonomous vehicles, electric scooters, home assistants, smart meters, etc. Research around these devices would create additional complexity in terms of visually representing incoming data for a multitude of sensors across potentially vast numbers of devices, and in terms of the platform and methods used to communicate with users. Questions still remain about the content, data visualisations and capabilities that should be supported by an ethnographic dashboard. There is an opportunity to investigate best practices for data visualisation and participant-researcher communication in a collaborative co-design process accounting for the various stakeholders involved in industrial design research, including end users, designers, researchers, and manufacturers.

When adapting the method to be used by industry ethical and transparent data gathering practices are essential. A striking example of the extra precautions that would need to be in place when utilising a similar approach around industrial IoT products has been the public outcry against Amazon using human transcribers to verify language transcription for Alexa (Day, Turner and Drozdak 2019). While the practice of human transcribers to help improve voice recognition tools is understandable in itself and is similar to the methodological proposition that we make with this paper, i.e. use data gathering around a smart product in order to generate design insight, we would like to outline several differences in our approach. The key differences are that taking part in our study required a strictly opt in form of consent, we viewed the gathering of audio/video and location data as too personal and thus avoided it, and there was no outsourcing of data analysis from the data collected by the speakers. While we see potential for our method to be used within industry we hope that great consideration would be given to issues around informed consent, opt-in data gathering, and non-personally identifiable sources of data.

We argue that by investigating contexts of use, we can build up an understanding of the behaviours, motivations and issues around a product, which can inform product design and development. This can be achieved by using machine learning and chat-bots to support real-time communication and make the best use of limited time and attention. Beyond discovering design opportunities this method has the potential to open up a dialogue between manufacturers, consumers, and ethnographers about the future of smart technology in terms of development, data collection, privacy and security. Making data-streams visible and accessible to users, even when facilitated through a researcher, can shift power dynamics

around data capture. This dialogue and engagement around data can further the practice of “domestication of data, in which we, alongside the people we study, are participants” (Nafus, 2016).

## CONCLUSION

The method that we propose within this paper builds upon work developed by the EPIC community. It reviews recent developments within contingent ESM, ethno-mining, thing ethnography and Ethnobot, where ethnographers utilise technology as a means for data collection in the wild. Our work identifies an opportunity for researchers to carry out real-time collaborative sensemaking by visualising live data streams, responding to activity they observe and communicating with participants near the time of activity.

We further contribute a study that tests the method, illustrating how it enables contextual inquiry, ground truthing of data, real-time problem solving, and allows participants to take on a collaborative role in research. We have shown that this method captures both obvious and subtle design insights, and can help enlist participants into active roles around the redesign of products. By avoiding on-device cameras and microphones we have decreased some of the ethical ramifications of background data capture. Finally, we have examined the technical issues around scaling the method up, and argued that there is an opportunity of utilising computational techniques in order to work more effectively with large populations and within industrial contexts.

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**PechaKucha Session**

## **Expanding Ethnographic Agencies**

Curators: Alexandra Mack (Ad Hoc) & Emma Saunders (Empathy)

This Pecha Kucha session explores agency through a broad lens. It encompasses not just the agency of the people--and machines--on which we may focus our ethnographic lens, but also the agency that we as ethnographers exercise, knowingly or unknowingly. As we engage with our subjects, we become participants in their world, and our investment in that world impacts both how we view it and how we relay it to others. Likewise, we come face to face with the question of who and what are we trying to understand, and how this reflexive lens both forces us to confront the degree to which we choose to be change agents versus observers and reporters.

## Creating Agency What Ethnography Can Learn from Storytelling

ANNA ZAVYALOVA

*This PK explores the relationship between ethnography and post-modern storytelling techniques that shift the locus of agency towards the audience and away from the protagonist. The presentation builds on insights from a project about the future of storytelling, and explores the ways in which various storytelling formats (theater, film, comics) promote creative agency through immersion and interaction. The PK shows how through a deep engagement with the lives of the people we study, and our ability and willingness to take clients along with us, we as business ethnographers assume a sense of 'creative' agency, which allows us and our clients to take greater ownership of the story we tell.*



“Lego Dimensions Dolls” by Zhen Hu

**Anna Zavyalova** is an anthropologist, socio-cultural explorer and a keen writer, passionate about applying the ethnographic method to real business challenges. With over five years’ experience in academic and commercial research, she has carried out global ethnographic studies spanning technology, retail, automotive, and organisational change. Anna lives in London and is currently working as an independent consultant, combining her passion for ethnographic research and storytelling.

## Creative Photography through Ethnographic Research

GABRIELA OLIVEIRA, *INSITUM*

*This is a short story of when my sides of researcher and photographer met during a trip to the rural countryside of Brazil, where I went to research about internet connectivity, but ended up learning more about human relations. Photography creates connection between people, much like ethnography, and they interlace in a deeper level than just registering of fieldwork. Visual registration of research can be as valuable as the content gathered from the conversation, and photography can enable both analysis and creativity in a researcher, by prompting him or her to train an observing eye to both content and surroundings. Thinking of photography as a tool as valuable as interviewing activates new ways for researchers to use their humanity to face ethnographic research.*



“Hospitality” © Gabriela Oliveira

**Gabriela Oliveira** is a Brazilian research strategist based in São Paulo.  
[gabriela.a.deoliveira@gmail.com](mailto:gabriela.a.deoliveira@gmail.com)

## “Resistance is Possible” The Ethnography of Roleplaying

NATHAN LEBLANC, *Scoop*

*Roleplaying games, such as the popular Dungeons & Dragons, ask players to take on roles of particular people and contexts. As a researcher, my experience conducting playtesting and ethnographic work for a roleplaying game on the Holocaust called “Rosenstrasse” profoundly affected me. In this PechaKucha, I ponder how roleplaying games might inspire the communication of ethnographic insight. As a medium in which storytelling isn’t linear or prescribed, how can roleplaying games effectively transfer cultural understanding? Just as a Games Master and game design facilitate this knowledge transfer, perhaps ethnographers can use techniques similar to roleplaying to increase change-making by enabling greater agency in stakeholders and teammates.*



A scene of the roleplaying game *Rosenstrasse* by Moyra Turkington and Jessica Hammer. Photo courtesy of Professor Jessica Hammer, Carnegie Mellon University.

**Nathan LeBlanc** is a design researcher currently working at Scoop. He holds a BA in Anthropology and Linguistics from Grinnell College and a Masters of HCI from Carnegie Mellon University.



## Borders and Walls

### What Is the Agency of Architects in Geopolitical Conflicts?

ANE GONZALEZ LARA, *Pratt Institute*

*Boundaries and borders have generated lots of attention in the political realm of our country over the last years. The proposed Wall between the United States and Mexico has created different perspectives from architects and builders across the country. Following this debate, a question arises: What is the agency of architecture and architects in this issue?*

*This presentation focuses on a Borders Studio taught at the University of New Mexico School of Architecture, a borderland school that draws students from both sides of the border. The studio was created after seeing how polarized and diverse the opinions about the proposed wall were among architects and builders and in order to stimulate the critical thinking abilities of the students.*

*The studio involved a series of projects that tackled different scales. Each student found their own voice on the conflict during the semester and the studio created a platform for them to bring issues like immigration, labor and politics to the classroom and question the agency of architects in geopolitical conflicts.*

*The presentation reflects the students' designs to create alternatives to the proposed wall focusing in the Chamizal Park in El Paso and Juárez.*



US/Mexico Border, El Paso/Juarez— © Ane Gonzalez Lara

**Ane Gonzalez Lara** is the co-founder of Idyll Studio and a professor with wide ranging interests in Ibero- and Latin-American contemporary design and urbanism. Her professional work with Idyll balances social and cultural concerns with extensive formal and material

research. She has developed academic research initiatives as part of her studio teaching that have examined the United States-Mexican border and the Korean demilitarized zone, and she has hosted conferences on these topics including a roundtable at last years' Venice Biennale. She received her Master and Bachelor of Architecture degrees from the Escuela Tecnica Superior de Arquitectura in Navarra, Spain. Prior to working at Pratt she taught at the University of New Mexico and University of Houston. [Agonz370@pratt.edu](mailto:Agonz370@pratt.edu)



## Digital Selves and Distributed Agency Redefining the Subject of Ethnography

GUNES KOCABAG, *Independent Consultant*

*Digital identities are key to almost all aspects of life today. What happens when digital identities grow beyond just being partial, one-dimensional representations of us, but become fully autonomous digital selves who can act on our behalf. Who or what will be the target for businesses trying to capture new customers, and what does that mean for our work as business anthropologists? Through practical examples, I take the audience through a thinking exercise and argue that future ethnographic practice needs to get beyond defending its own domain, open up and seek collaboration with many more disciplines that can complement our work as ethnographers.*



“Solitary Penguin in Simon’s town” by Francisco Arnela

**Gunes Kocabag** is a researcher and strategic designer. She has worked with multi-disciplinary teams in projects across industries, and led research expeditions in Europe, Americas, Africa, Asia and Australia, to develop new services, user experiences and business models that provide sustainable value for business and society.

## Breaking the Language Barrier India, the Digital Revolution, and Human Agency

SHUBHANGI ATHALYE, *Convo Research & Strategy Pvt. Ltd*  
STUART HENSHALL, *Convo Research & Strategy Pvt. Ltd*

*India is pioneering the future of low and illiterate populations and as a result changing the course of AI, human agency and how we empower the next connected billion+. In a country with such a complex linguistic and demographic landscape the challenges are mammoth. However, with the sudden cheap and easy access to the internet, mobile technology is proving to be the vehicle for human agency. It is proving to be the catalyst and throwing up new tools especially for those poorly equipped to adopt.*

*As an ethnographer I'm always struck with how the user behaves, adapts and changes to magical new tools. We go from a sense of wonder to a new form of tech literacy that will quickly surpass what they were ever able to do before. The questions posed are: How can technology reframe intention for lower literate populations? What new tools can be made available for the vernacular language users to help them express? Will these new emerging tools impact on how we interact in the future as well.*



## Paper Session

# Ethnographic Agency

Curator: Anne Harris (Digital Ethnography Research Centre, RMIT University)

This year's EPIC focuses on ethnography in a range of contexts and expressions, with particular attention to agency. The two papers in this session explore different ways of approaching ethnographic research in diverse contexts. For Levin, through corporate industry environments or agencies. For Golias, economic agency through sustainable people-centred ethnographic practices to shift organisational cultures. The authors ask us to reconsider traditional binaries like quantitative and qualitative, in contemporary work contexts that are more demanding, more dynamic and more diverse than ever before. Levin challenges us to think beyond qualitative ethnography in data-driven industry settings, but acknowledges how this requires mindset shifts as a first step. Golias urges us to use ethnography as a service design process that focuses on people and a sustainable planet. Together, these papers suggest ways that ethnographers can have more agency both within and beyond corporate KPI's and cultures. Both urge us to go beyond relying on last century's ethnographic approaches to address this century's challenges.

## Ethnographic Agency in a Data Driven World

NADINE LEVIN, *Facebook*

*This paper argues that ethnographers can gain increased agency in data-driven corporate environments by increasing their quantitative literacy: their ability to create, understand, and strategically use quantitative data to shape organizations. Drawing on the author's experience conducting strategic user research at a technology company, the paper explores how the ability to engage with quantitative data can increase ethnographers' independence and autonomy within organizations, and can also up-level the role and value of qualitative research. The paper also explores how a deep familiarity with quantitative data can enable ethnographers to imbue quantitative data itself with new forms of agency, and can ultimately give ethnographers the tools to change institutions from within. With a greater understanding of how quantitative data is made and used, ethnographers can ensure that data is collected in representative ways, point out the limitations of existing metrics, and argue for new ways of measuring and understanding social life.*

### INTRODUCTION: A SOCIOCULTURAL ANTHROPOLOGIST AMONGST THE ENGINEERS

The world of modern technology companies, similar to other contemporary business environments, is full of numbers. These environments are made up of and thrive on data, which takes the form of measurements collected by apps and phones, survey results, metrics, monetary revenue, and key performance indicators (KPIs). In data-driven business environments, ethnographers often work alongside teams of engineers and data scientists who communicate with statistics, or in organizations where large-scale patterns drive decision making. Doing ethnography in these contexts means, increasingly, getting familiar with quantitative data<sup>1</sup> (Knox and Nafus 2018).

And yet, ethnographers often lack a fluency and familiarity with quantitative data, which can limit their engagement with numbers and the social world in which they are pervasive. In the academic world, social anthropological training—in contrast to other social science disciplines like economics or psychology—often includes little to no exposure to statistics or programming languages. In business environments, ethnographers face large barriers to learning quantitative skills like statistics and coding. Researchers in the already liminal field of user experience research must produce results on fast timelines, and may not be able to justify the time and space needed to learn new quantitative skills. As a result, ethnographers often have less familiarity with quantitative data. They may lack the skills to analyze quantitative data or write code. They may struggle to interpret quantitative data in the form of database tables, statistical models, or charts and graphs. Or, they might not have the deep understanding of data that is required to use quantitative data and insights to drive strategic organizational change.

This distance from data is further evidenced in the anthropological and social studies of science (STS) literature on quantitative data, which has tended to focus on its end products—papers and visualizations, societal implications (Miller 2015; Dougherty 2015)—instead of the everyday practices that go into negotiating and making sense of quantitative data (Levin 2014a; Starosielski 2015; Buur, Mosleh, and FYHN 2018). This has left ethnographers, in both industry and academic settings, with few playbooks for engaging

critically with quantitative data, or for doing “participant observation” on the practices that shape how quantitative data are made and used.

This paper takes as its problematic the author’s three years of experience working in a large, data-intensive organization, where ethnographers often struggle to gain traction with their work because of an inherent bias towards quantification and numbers (Maiers 2018). By providing an autoethnography of my experiences learning quantitative methods (Jones, Adams, and Ellis 2016), I argue that quantitative literacy—a deep familiarity with data, as well as knowledge of how to use quantitative skills to shape an organization—can give ethnographers expanded agency<sup>2</sup> to do research in and impact data-intensive businesses. To be effective industry researchers, ethnographers must not only deliver insights into their subject area, but must also understand and move within the larger systems in which these insights operate (Cefkin 2010). Fluency with coding and statistics can give ethnographers increased independence and authority within organizations, by enabling them to speak the same language as their stakeholders, and by helping them more clearly articulating how quantitative and qualitative research can complement each other. This ability to not only work, but also tap into the social power of numbers, becomes a powerful tool for gaining ethnographic agency.

However, quantitative literacy not only gives ethnographers new agency, but can also enable them to imbue quantitative data itself with new forms of agency and meaning. Quantitative skills can empower ethnographers to ask crucial questions about how data is used to make decisions in organizations. This can, for example, highlight crucial gaps in datasets, making space to question whether business outcomes are measured with the correct metrics. Quantitative literacy can give ethnographers the agency not just to critique institutions, but also to change them from within. With a greater understanding of how quantitative data is made and used, ethnographers can ensure that data is collected in representative ways, point out the limitations of existing metrics, and argue for new ways of measuring and understanding social life. With quantitative literacy, anthropologists can gain the tools to re-negotiate and restructure the quantitative environment around them, by changing the processes through which data shape and have power in the world.

And yet, it might not always be possible, necessary, or ideal for researchers trained in ethnography to pursue quantitative literacy. If researchers do not have the skills, opportunity, or desire to develop quantitative literacy, does their impact suffer? Does this emphasis on quantitative literacy create false expectations that everyone can and should be able to tackle both the quantitative and the qualitative? Do qualitative approaches become relegated to the less influential projects and parts of the company? Might promoting a more quantitative way of viewing users and technology make it unintentionally harder in the long run to get buy-in for qualitative approaches and insights?

Ultimately, this paper asks, how can we better equip ethnographers to have more agency as they enter this world of quantitative data, statistics, and algorithms? What are the best approaches and theories to help ethnographers work and succeed in data-intensive environments? How can the agency that comes with quantitative literacy help ethnographers have more impact, by enabling them question and influence the structures and values surrounding data-driven decision making? And ultimately, what does this need to have quantitative literacy in order to gain a “voice” within technology companies say about the current culture of user experience research, or the current culture of knowledge and values within data-driven organizations?

## PART 1: GAINING AGENCY BY LEARNING THE LANGUAGE AND SKILLS OF QUANTITATIVE DATA

In this first section of the paper, I reflect on my experiences becoming fluent in creating, transforming, understanding, and using large datasets at a well-known tech company. I describe the process of carrying out a large-scale survey project, where I learned how different sampling methods impacted survey data, wrote code to analyze this data with statistics, and told stories about this data to stakeholders to influence company strategy. Through my work, I came to do participant observation with quantitative data not in a cursory, surface-level way—as can happen through reading papers or relying on second-hand accounts in interviews—but by deeply engaging in the creation, analysis, and socialization of quantitative data. Drawing on this experience, I reflect on how quantitative literacy can help ethnographers have more autonomy and influence in an organization, and can simultaneously uplift the status of qualitative research methods and insights in data-driven environments.

For my PhD, I did an ethnography of how scientists worked with large datasets and statistics. I began my research at a laboratory at Imperial College London thinking that I would study academic-industry collaborations, and ended up focusing on how scientists were trying to understand the complex system of metabolism with multivariate statistics (Levin 2014a). I carried out participant observation with scientists in the field of “metabolomics,” as they attempted to understand the role that metabolism played in enabling living beings to interact with their environment over time. I watched scientists and clinicians put samples of urine, blood, and tissue into mass spectrometry and nuclear magnetic resonance machines, and also observed how they analyze the ensuing datasets—which contained hundreds of thousands of data points, and could be several gigabytes large—with statistics and algorithms.

Ultimately, these statistics and algorithms became the focus of my participant observation with scientists. Although ethnography is typically thought of as a distinctly qualitative methodology, anthropology, it turns out, has always had a relationship to numbers (Curran 2013). Adam Kuper writes, for example, that early British anthropology had an “overriding concern with the accumulation of data” (Kuper 1977, 5), and that Malinowski looked to collect “statistical documentation through concrete evidence” as part of his ethnographies (Kuper 1977, 15).

Consequently, as I carried out participant observation with scientists who were using complex, black-boxed machine learning algorithms (Eubanks 2018), I came up with particular ways to engage with these data practices. I shadowed researchers as they did lab experiments and analyzed data in MATLAB and other statistical software. I pored over scientific literature and attended training courses and seminars. Even though I had no formal training in statistics, I learned to “speak the language of data” by familiarizing myself with the theory behind principal components analysis, supervised learning techniques, and neural networks (Levin 2014a). By gaining a deeper understanding of virtual and intangible data-rich systems, I was able to reflect on how quantitative data was reshaping concepts like metabolism and health, creating friction between scientists and clinicians (Levin 2014b), and shaping notions of “persons” and “populations” in healthcare systems.

Although I spent much of my PhD thinking and writing about how data was impacting society (Levin 2018), in academia, I did not need to learn how to actually *do* data analysis. To

write an ethnography about data and statistics, it was enough to shadow scientists, to understand the theory behind statistics, and then to talk to participants about how data was impacting their understandings of metabolism and health. My success as an academic was in no way tied to my ability to do quantitative work, and as such, I had no incentive or reason to learn to do data analysis.

In my industry job, however, I found myself in an environment where having quantitative skills seemed to unlock a number of doors and opportunities. Before I began working in the tech industry, newspapers and magazines seemed to portray ethnography in business world as an almost mystical tool for unearthing consumer insights (Wood 2013; Singer 2014) or for enacting organizational change (Huhman 2018). In my own experiences, however, most of my colleagues—other user researchers included—did not understand the nature or value of qualitative data. They did not understand which business questions would best benefit from ethnographic inquiries, or that qualitative insights were never meant to be “representative” (Maiers 2018). As a result, business decisions were still largely driven by quantitative insights from surveys and by behavioral shifts seen through the lens of log data.

In my everyday world, qualitative data was often seen as a storytelling tool, and little more. “Qual,” as it was colloquially called, was relegated to the “human” or “ethical” dimension of big data, rather than existing as an equal form of data in and of itself (Arora et al. 2018). I often advocated that qualitative data could be used to come up with new product directions, or to develop principles and values for product design. But because I was not producing data that would neatly fit with existing metrics—in the format of a survey that said “4% of people thought X with product Y”—many of my stakeholders did not know how to operationalize my qualitative insights.

After about a year in my job, as a mostly qualitative researcher whose interaction with data was limited to an occasional analysis of survey data in Microsoft Excel, I realized that my lack of quantitative expertise was preventing me from engaging in strategic conversations in the company. I struggled to engage with data scientists and engineers, as they talked about the numeric results of A/B experiments. I also found it challenging to engage with other user researchers who came from more quantitative social psychology backgrounds, as they talked about complex survey analysis in the programming language R, with which I had no familiarity.

I found myself caught in a double bind. I wanted to advocate for qualitative methods within the organization, but I realized that I needed to become more adept with quantitative methods to do so. On the one hand, I wanted to grow my identity within the organization as an ethnographer and anthropologist, but on the other hand, I wanted to have access to new projects, relationships with stakeholders, and forms of impact. I started to wonder if a deeper understanding of the ways that quantitative data was being created, manipulated, and used would help me understand and influence the data-driven organization in which I worked.

Working in a fast-paced company, I did not have the luxury of continuing my doctoral research, by doing extensive interviews or participant observation as the primary method of becoming more fluent with quantitative data. Instead, I needed a more practical approach. I began to learn how to conduct more complicated survey projects, as a way to develop a greater familiarity and understanding of quantitative data, and also as a way to strategically advance my position within the organization. But as I started to improve my knowledge of survey design and sampling, I still had to rely on data scientists and quantitative researchers



for help with querying databases, or with figuring out the right statistical tests to use on my data.

At the time, I was still using Excel to analyze my data. I had learned this computer program during my undergraduate studies, as I had taken classes in biology or chemistry that only required simple data manipulation like adding or calculating p values. But with survey data, I began running into an increasing number of problems with data manipulation, particularly as the datasets became bigger and more complex. Each time I analyzed a subset of my survey data or carried out a new type of analysis, I had to create a new tab within an Excel workbook. This led to a proliferation of tabs and hand-coded calculations, leading to issues with version control and mistakes with calculations.

Observing that the “expert” quantitative researchers throughout the company were analyzing their data in R, an open source statistical software package, I decided to follow in their footsteps. To learn R, which has a notoriously complex syntax (Machlis 2017), I took advantage of the several in-person and online training courses that my company offered. But learning R syntax abstractly, without concrete datasets to solve for, was challenging. As a result, I designed a moderately complicated survey, and started practicing data analysis with my own datasets. Knowing that I wanted to answer specific questions about the data, I was able to translate my working process in Excel into R, by looking at “R Cheat Sheets” (<https://www.rstudio.com/resources/cheatsheets/>), drawing out visual diagrams for how the data should be manipulated, and by debugging issues on the website Stack Exchange (<https://stackoverflow.com/>).

As I engaged more deeply with quantitative methods than I had during my PhD, I went through a process of becoming fluent not just with the language, but also in the skills of quantitative data. Beyond a high-level, theoretical understanding of statistics, I learned how to conduct representative sampling with large surveys, how to effectively structure survey questions to control for response bias, how to join survey data to other data in our databases, how to write code to analyze data quickly and efficiently, and how to tell stories with numbers through graphs and other visuals. As I became more fluent in the skills needed to manipulate quantitative data, I also developed a greater understanding of the types of research questions that would best benefit from qualitative versus quantitative approaches, as well as how the two methods could be combined to drive the greatest impact. I could more clearly identify when research—take for example a study to understand which strategies people were using to learn new things—would benefit from a survey rather than a qualitative study.

As a culmination of my efforts to learn more about quantitative data, I completed a large survey project, which delivered a number of insights that shaped company strategy. I used stratified sampling and weighting—key strategies for minimizing bias—to illuminate the complexities of the product’s user base. This caused stakeholders to question their assumptions about how and by whom the product was being used. Instead of presenting the survey results as an average, which would have lumped the experiences of different populations into one number, I showed how the survey results varied depending on where the user lived, how old they were, and whether they used an android or apple phone. The “user,” which had formerly been an amorphous concept (Amirebrahimi 2016), was suddenly anchored in rich contextual information. As a result, my stakeholders were forced to consider how social environments shaped peoples’ interactions with technology, because



there was incontrovertible quantitative evidence that gave texture and shape to a formerly “average” user.

These kinds of insights, however, would likely not have emerged had I partnered with a quantitative researcher or data scientist instead of doing the work myself. Because I was no longer reliant on others to work with data—to query databases or carry out statistical analyses—I gained the autonomy and freedom to approach data with my own unique perspective. Once I understood the common ways that researchers approached surveys, I began to question the decisions that were made about which differences in data to highlight, or about how data should be visualized. I approached my survey data with the eyes of an ethnographer, with a view towards drawing on the multitude of dimensions in the data, in order to highlight cultural, social, and regional differences.

As my quantitative work became more visible in the organization, somewhat unexpectedly, more stakeholders began to pay attention to my ethnographic work. As I paired qualitative and quantitative approaches within larger projects, the people I worked with began to understand how in-depth interviews and ethnographic insights were both valuable types of data, which were part of a larger story that could be told about a problem space. By uncovering a number of interesting trends in the survey, I had created new opportunities to do ethnographic research with specific populations. While the quantitative survey data provided the “what,” qualitative methods like ethnography helped uncover the “why,” the reasons underling the differences in the data.

Doing quantitative work ultimately became a way to elevate the status of my qualitative work throughout the organization. Because my ethnographic analysis became data-driven, my stakeholders perceived it to be more rigorous and high quality. The close relationship between quantitative and qualitative research helped to circumvent the all-too-common criticism that qualitative research lacked statistical validity or situational generalizability (Mayers 2018). Here, ethnography was not just a way to give texture to quantitative data. Instead, quantitative methods emerged as a way to give new value and life to ethnography and qualitative data itself, by leveraging “big data” to open up opportunities to explain cultural differences (Curran 2013).

My experiences with quantitative research not only led to new opportunities for qualitative research, but also transformed my role and status in the research organization. Following this survey project, I was given license to do more strategic projects—and even assumed a new role as a “pathfinding” researcher, focused on the future of the business—because I had learned to deliver insights in a shape and format that the organization recognized and understood. I was able to take on projects that were bigger in scope and spanned longer timelines, as I was no longer classified as a “qualitative researcher” and could now address complex topics using whatever method I needed. As a result, researchers in the organization began to solicit my help and advice with tackling complex problems, transforming me into a trusted thought-partner for driving company strategy.

My push to create more impact by upskilling in quantitative methods did, however, have some unintentional consequences for ethnography and ethnographers within the organization. Research leadership began to promote the hybrid quantitative-ethnography approach that I had developed as an “ideal” model for other researchers. And yet, other ethnographers who had less exposure to quantitative environments or less flexibility to pursue skill development in their free time, struggled to adopt this model. By emphasizing the intertwined nature of surveys and ethnography, I had helped to create false expectations

that anyone, regardless of their background or resources, could and should gain experience in quantitative methods as a pathway to having greater impact. While quantitative literacy increased exposure to and understanding of ethnography in some ways, it also devalued the method and placed it in a more precarious situation in other ways.

In summary, this section of the paper shows how by developing quantitative literacy, ethnographers can gain the ability and agency to gain more autonomy and influence in data-driven organizations. While organizational cultures and social norms—like the dominance of quantitative data and reasoning—can create power asymmetries that make it difficult for qualitative research to have impact, ethnographers are not helpless. Just as patients with mood disorders can repurpose “constraining” technologies like in-vitro fertilization or brain imaging for their own strategic ends (Lock and Kaufert 1998; Cohn 2004), ethnographers can “hijack” quantitative methods for their own strategic ends within organizations.

Here, for example, quantitative literacy can become a strategic tool to help ethnographers gain back some of the agency that was lost when ethnography was fit into the user-experience framework (Amirebrahimi 2016). When this occurred, the focus on and language of “the user” flattened research into the binary of the user and the used, removing much of the richness of peoples’ local, social, and culturally-specific engagements with technology. While ethnography’s multifaceted engagement with culture and power is often reduced to the individual usage of a device, quantitative data can help bring context, specificity, and place to qualitative data, by showing how technology usage varies by dimensions like age, gender, and country.

Ultimately, in “expert” environments like tech companies, ethnographers can more critically and meaningfully engage with technologies like databases and algorithms by becoming fluent in the language and end-to-end processes of data. While such expert knowledge may not be necessary in the context of the quantified-self movement (Nafus 2016), a lack of expert knowledge in tech companies can preclude ethnographers from participating fully in the social life and strategic decisions of organizations. In this way, possessing certain skillsets, or not possessing others, can alter power dynamics and disrupt the so-called “big data divide” that exists internally in organizations.

## **PART 2: IMBUING QUANTITATIVE DATA WITH NEW AGENCY, BY SHAPING THE NORMS, VALUES, AND POLITICS OF NUMBERS**

In this second section of the paper, I reflect on the process of driving impact and decision-making with a large-scale, hybrid ethnographic and quantitative project to measure the relationship between digital skills and product usage. I talk about how *doing* quantitative work, rather than just observing it, can give ethnographers critical insight into the politics of data in a large institution: into what is and is not being measured with quantitative data (Crawford 2013, 2016), into how the contingency of data is negotiated in decision making (Latour and Woolgar 1986), and into the ways that certain forms of data come to be valued and have power (Räsänen and Nyce 2013; Biruk 2018; Rajan and Leonelli 2013).

During my PhD, I had used my understanding of the entire lifecycle of metabolic data to develop a theoretical toolkit for approaching data practices in the laboratory. By carrying out ethnography in a data-intensive environment, which might appear off-limits or intimidating to anthropologists, I came to see how numbers were not “stable and objective measures of reality” (Biruk 2018), but had complex social lives and were embroiled in power

dynamics. In this way, I began to reflect on the social aspects of how data were made, reasoned through, and used, and how these “data practices” shaped how people and societies functioned. My work with numbers gave me insight into the politics of data (Boyd and Crawford 2012), and gave me a theoretical toolkit (Levin 2018) for analyzing the claims to objectivity (Daston and Galison 2007), newness (Boellstorff and Maurer 2015), and accuracy that surround quantitative data (Gitelman 2013).

As I transitioned out of academia, I was confronted with similar claims and concepts around quantitative data in an industry environment. I saw how data practices affected strategic decisions around which business needs and populations should be a priority (emerging markets or western markets?), and also around which metrics should be used to measure success (consumer satisfaction or the number of active users?). Becoming deeply involved in quantitative research was a way to apply the theories I had developed during my PhD to my industry work—theories which could ultimately help me understand and function in the organization. Although I was technically doing “user” research, quantitative methods enabled me to scrutinize not just the end users of the system, but also the system itself.

Focusing on the practices that create and shape data, as well as on the organizational structures in which data operates—in what Julia Haines refers to as “multi-dimensional ethnography” (Haines 2017)—can help overcome common dichotomies like quantitative versus qualitative research. For example, actor-network theory (Callon 1984), which sees various “actors” operating as “nodes” within a network, has successfully shown how both human and non-human entities, like machines and data, can have agency (Mol 2002). But, as Marilyn Strathern points out in *Cutting the Network*, the webs of inter-relations that connect the nodes in networks are not all evenly spaced and distributed (Strathern 1996). Networks, like numbers, have distinct qualities, such that some connections between nodes are longer or shorter than others. Agency and power can be unevenly distributed in networks, highlighting how some points of view—like quantitative insights from log data and surveys—have more power than others—like qualitative insights from ethnography.

I became fully immersed in the politics of data when I began a project to understand and measure how issues with digital literacy were leading to negative product experiences. Leading up to this project, my ethnographic work with older adults in the California Central Valley, as well as with people who were newer to the internet in Vietnam, had revealed how phone interactions that Silicon Valley often took for granted—uploading and posting pictures, formulating Google searches—were difficult for some populations. As various stakeholders at the company began to ask what role digital skills played in the amount of time or frequency that people engaged with digital products, I carried out international fieldwork in Brazil and Indonesia. The goal was to understand the range of problems people with low digital skills encountered, and to identify how these problems were different than the problems frequently assumed or encountered during research in Silicon Valley.

This fieldwork identified a number of design problems that people with lower digital skills encountered, such as not understanding how hidden press-and-hold gestures<sup>3</sup> worked, or not understanding how to navigate a complex product. My qualitative data also indicated that when people with low digital skills had trouble interacting with the product, they were more likely to experience problems with safety and well-being. For example, if someone did not know that privacy as a concept existed, they might be more likely to share information to a wider network than they realized, revealing personal information to strangers.

Alternatively, if someone did not understand that they could report behavior that was overtly sexual or violent, they might continually be exposed to harmful or negative content. Ethnography was crucial to generating these insights, as it gathered feedback from people who typically did not participate in surveys, or who might not have the knowledge or vocabulary to describe their problems during more cursory qualitative research.

Ultimately, this research spoke to a fundamental gap in knowledge at the company, and also in the academic and non-profit world. Studies of digital skills were almost entirely conducted in North America and Europe, leaving out the experiences of the majority of the world's population. To address these gaps, I began advocating for a set of product changes—more simple user interfaces, more education to help people understand complex concepts, spaces within the product where people could build confidence when exploring new features—that would specifically solve problems for people with low digital skills. But as I struggled to convince other people in the organization to work on these initiatives, I also began to question if the business was measuring its outcomes in a way that could incentivize, or capture the benefits of, this kind of work.

For example, one of the major ways that the company measured success was by tracking growth—the number of people using the product—and engagement—how often during a month those people used the product. These measures of success, however, could sometimes be at odds with improving peoples' understanding of features, or with reducing peoples' potential to be confused by complex features. In one paradoxical example, clarifying how a certain feature worked actually ended up decreasing engagement with the product, because people became aware that they were making mistakes with the feature, and therefore began to use the features more cautiously. In another example, product improvements that reduced the spread of negative or misleading content also decreased growth, as people had less content to engage with overall. These examples demonstrated how it was extremely challenging to developing measurement frameworks that articulated the right balance between incentivizing growth and mitigating potential risks.

During my struggles to convince people to make products better for people with low digital skills, I pragmatically realized that qualitative data would not be enough. To motivate change, I needed to come up with a framework for quantitatively measuring digital skills and their impact on product metrics like growth and engagement. Despite the existence of external literature suggesting that a large proportion of the population had low digital skills (Kankaraš et al. 2016), I was constantly asked, "Can we size this?" Without a metric, I could not concretely say that people with X level of skills used the product Y percent less, and that the company would have Z percent gain in engagement if it focused on improving skills rather than launching new complex features. I realized that stakeholders would not act on qualitative insights unless they could be corroborated by quantitative data. In a business driven by numbers, product managers and engineers needed to be able to quantify the impact of digital skills relative to other factors, to ultimately decide whether they should invest in digital skills relative to other areas of opportunity.

As a result, I expanded my project on digital skills to include a quantitative phase, where I worked with academics to develop a framework for measuring digital skills across populations. As ethnographers, when we delve into and get involved in the practices of data, we do not simply represent and repeat numbers from a business angle. Instead, we have an ethical obligation to represent the needs of users of the product, and to articulate how technology relates to peoples' social realities. With quantitative survey work, I

attempted to elevate the problems and needs of group of people who were not only less engaged with the product, but whose voices had also historically been silenced because the company lacked an appropriate measurement tool. Qualitative work had highlighted this crucial gap in our metrics, which I could now fill with quantitative work.

As I developed a large-scale survey to measure digital skills, I leveraged insights from my qualitative work to develop survey questions, and also to make the survey's sampling as representative as possible. I saw how some of the past survey work at the company had unintentionally excluded the voices of people with lower digital skills, by over-focusing on populations who, due a variety of structural factors, were more likely to take surveys. I drew on my deep understanding of surveys to make the process of data collection more inclusive, oversampling people who were newer to the product and used it less. I imbued my data and the process of administering surveys with new agency, by changing which voices were represented in the data. Even if surveys could not fully reach or elevate the experiences of people with lower skills in the same way as ethnography, the changes I enacted in the survey process ensured that product decisions and changes would include the experiences of people with lower digital skills.

By using my quantitative skills to run a carefully crafted survey, I began to work with product teams to suggest how we could incorporate measurements of digital skills into their product frameworks, by showing how digital skills were correlated with metrics teams were already tracking. Some teams were highly receptive to this information. They saw it as a tool for tracking which populations were more likely to struggle with products, as well as which populations were more likely to benefit from product fixes. While teams had struggled to understand and act on ethnographic findings, as I translated my qualitative insights into a quantitative form, I suddenly presented results in a language that my stakeholders spoke.

As my quantitative research elevated an awareness of digital skills throughout the company, my work began to reshape how people used metrics in product development. Teams began to focus more on new users and people using lower end phones, placing more value on the experiences of these under-represented groups. By combining ethnographic insights with survey insights, I had found a way to pragmatically navigate and make impact in a business environment that was dominated by numbers and metrics. Ultimately, I gave new agency to quantitative data by transforming who and what it represented, and also by changing the way people used and thought about it.

However, not all teams were receptive to qualitative insights, even if they were “backed up” by quantitative data. While my project encouraged stakeholders to apply design changes and principles to reduce complex product experiences, some stakeholders felt the need to quantify complexity itself. Another group within the company began to develop a “complexity metric” that could identify the numeric complexity of a given design. However, this complexity metric was rooted in computer science and psychological approaches to complexity, which did not account for the various ways that people around the world perceived and experienced “complexity” as a concept. Moreover, this complexity metric could only identify the “what” and not the “why” of complexity, leaving stakeholders with a tool to track but not fix the underlying causes of complex product experiences. Because the complexity metric entailed a purely quantitative approach, instead of encouraging the application of qualitative insights supported by quantitative data, it gained significantly more traction among some teams and stakeholders. This signaled that, even with the increased

agency and influence of quantitative literacy, furthering ethnographic approaches in data-driven organizations remained a challenge.

Despite these challenges, in this section I argue that by “getting their hands dirty” with quantitative data, ethnographers can become empowered to suggest changes to data-related methods and processes within data-driven institutions. By combining qualitative and quantitative insights, or by leverage quantitative methods to support qualitative findings, ethnographers can help institutions reflect on what is missing from existing datasets, can help teams figure out if they are collecting the right data or measuring the right, and can ultimately influence how (and what types of) data are used to drive strategy.

## **CONCLUSION: ETHNOGRAPHIC EMPOWERMENT IN DATA-INTENSIVE ENVIRONMENTS**

This paper shows how quantitative literacy—the ability not just to produce and understand quantitative data, but also the ability to use and apply it strategically within organizations—can give ethnographers the ability not just to critique institutions, but also to change them from within. By restructuring who has access to and can generate narratives about data, quantitative literacy enables ethnographers to renegotiate and restructure power relations in data-driven environments. As ethnographers learn how to do data-related tasks like running surveys, interpreting metrics and models, and writing code, they can challenge the epistemic authority of other disciplines that typically produce and control narratives about data. In doing so, they can gain a seat at the decision-making table to discuss important issues and tradeoffs in company strategy.

Having more of a strategic voice within an organization, and restructuring international power relations, is a difficult undertaking. The reality is that unless ethnographers learn to speak the language of and deeply understand quantitative data, they will struggle to enact institutional change, and to shift the power and value afforded to qualitative research. Knowing a system, rather than just the users of that system, allows for changes at the level of values and norms rather than products. This kind of thinking can reveal how and why complex social problems cannot be addressed with new metrics or algorithms alone. If the “smartness” of AI lies, as Clare Elish writes, in its power to process patterns and numbers with statistics (Elish 2018), then anthropologists need to play a role in the creation and deployment of statistical systems. Anthropologists must widen their horizons to focus not just on users and designs, but also on the machine learning algorithms, data architectures, and institutional hierarchies that make up data-driven organizations.

Ultimately, it is possible that promoting the adoption of quantitative methods and skills amongst ethnographers will increase the precarity of ethnography as a method and approach. The goal of this article is not to argue that all ethnographers *should* gain quantitative literacy, but rather that they *could*, as an avenue towards effecting institutional change. Quantitative literacy is one of many possible avenues that ethnographers can take, as they push institutions to reflect on whether data are made and used in the best and most ethical ways.

**Nadine Levin** is a senior researcher at Facebook, who conducts strategic work on under-represented populations, including older adults and those with low digital skills. You can contact her at [nslevin87@gmail.com](mailto:nslevin87@gmail.com) with any thoughts.

## NOTES

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1. Here, I use “data” as an umbrella term encompassing a variety of numeric, quantitative inputs and outputs, ranging from the datasets on which AI are trained, to the metrics companies use to make product decisions.

2. Here, I use agency to refer to the socioculturally mediated capacity to act (Ahearn 2001).

3. Common examples of this are: (1) using the “Like” button to add heart and other reactions to Facebook posts, or (2) tapping and holding an Instagram story to pause the progression to other stories.

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## **Toward Donut-Centered Design**

### **A Design Research Toolkit for the 21st Century**

CHRISTOPHER A. GOLIAS, *Google*

*The social and ecological challenges of the 21st century require a design research process that contributes to viable economic solutions. This paper proposes donut centered design as a hybrid of service design and ecological design that works within the donut economic model. It describes how private and public sector ethnographers can weld the best of these two processes by providing a holistic, empirical research foundation that seeks to provide distributed service innovation value to all within the limits of the planet. Donut-centered design addresses lacunae of the current innovation models by advocating multi-site assessments, multi-species ethnography, ecosocial blueprints and holistics metrics as important components of a regenerative design research practice.*

### **GROWTH CANNOT BE THE GOAL**

The 21st century global economy consists of competing, irreconcilable imperatives. On the one hand, the economy has been designed such that it must grow. On the other hand, expanding economic activity is extremely closely correlated to higher levels of pollution, emissions, resource depletion, climate change, and extinction in the biosphere. To make things more confusing, growth at the global level does not appear to have a predictable impact on global inequality, or a continued impact on human well-being beyond a certain point. Of course, economic growth is not entirely bad--20th century economic growth and attendant resource utilization contributed to unprecedented contemporary peace, cooperation and material prosperity (Pinker 2018). The problem lies in applying last century's solution to this century's problems, namely a growing population, increased ecological impact, and significant global inequality.

The US economy over the past decade is an example that economic growth and other measures of well-being have been effectively decoupled. Following the economic contraction that followed the 2008 financial crisis, the US economy expanded substantially and unemployment eventually reached an all-time low in 2019 ([www.bls.gov](http://www.bls.gov)). By these traditional measures, the economy would be said to be thriving. However, other measures of economic flourishing did not automatically follow the GDP trend upward. During the same period of time, wealth inequality has become greater. Mental health statistics have dipped since 2008--suicide in particular increased over 25% in the US in the meantime ([www.cdc.gov](http://www.cdc.gov)). Likewise 45% of those surveyed say they are satisfied with their jobs, down from 61.1 % in 1987. Thus GDP expansion cannot currently be equated to human flourishing.

Nor can future economic growth solve some of the most substantial problems facing humanity in the 21st century. Of the 21st century social and ecological challenges, economic growth is either tangential or antithetical to meeting the affront. Even global poverty is unlikely to be assuaged by growth alone. While global income inequality generally improved over the 20th century, the world remains very unequal ([ourworldindata.org](http://ourworldindata.org)). For those who wish to normalize inequality through economic growth, expansion must be maintained at relatively high rates for many years (e.g., 6% growth for 60 yrs) on end to achieve a world

above the global poverty line of 14,500 int-\$ (ourworldindata.org). However, if the world managed to achieve present USA-level consumption for all its citizens, the human footprint would eclipse 4 Earths (<https://persquaremile.com>). Clearly the population of humans living in that world would be able to take little solace in their relative equality. Economic growth only improves human lives up to a certain point, after which it appears to experience diminishing returns (Harrari 2016).

The 21st century's challenges span material-environmental limits and, in a related way, the impact of a state of perpetual growth on humans. Together they intimate that, in a physical sense, single-mindedly pursuing traditional economic growth in the 21st century is an unsupportable course of action. It is theoretically insupportable because 3% economic growth will literally boil the surface of the earth (dothemath.ucsd.edu) with entropic heat loss in less than 400 years with no help needed from carbon dioxide induced global warming. This is simply due to entropy. Economic activity traces a very tight correlation with total energy expended (Smil 2017). Thus with 3% growth, the entropy from energy use, renewable or not, would cause the surface temperature increase. It is practically impossible because unknowable ecological tipping points exist that, once triggered, could drastically reduce Earth's carrying capacity, thus effectively and automatically reversing the growth of the global human economy. On the social side, the rate of growth has led to a profusion of stress (Harrari 2016), exploitation and inequality.

Presently, the inhabitants of the biosphere, the Earth's layer of living organisms and their inter-relationships, find themselves squeezed between calls for growth and the empirical realities of pollution and depletion. Human inhabitants increasingly create an economic system that exacerbates capital, material and environmental inequality. Meanwhile, the benefits of growth and resource extraction are concentrated in developed nations and already relatively wealthy individuals, while the negative effects are experienced predominantly by socioeconomically marginal humans.

Yet growth is an imperative for the current economic instantiation, due in large part to the implicit collective expectation that the future economy will be larger than the present one. This belief, grounded in several hundreds of years of economic growth, has led us to design techno-monetary systems that take growth as a systemic assumption. To demonstrate the necessity of growth, take the United States Mortgage crisis of 2008 when a temporary decrease in the expansion of US credit, caused by mortgage defaults by marginal borrowers nearly led to the implosion of the international banking system due to the amplification effect of collateralized debt instruments. On a more mundane level, any interest-bearing loan carries with it a similar expectation--that 100 dollars of a loan will lead to a future where that dollar yields more than 100 dollars.

The same high-level expectations for growth have propagated through nearly all of our enterprises and institutions. Universities pursue increased enrollment each year in order to thrive. Rarely does a university actively curtail admissions. Corporations pursue increased adoption/revenue/market penetration each quarter, or it risks investor flight. Rarely does a corporation content itself with stable metrics but greater value, or upon being profitable, but not growing. The call for growth has trickled down to every corner of the economy, even ethnographic practice in industry. While changing the monetary system or economic system as a whole is beyond the scope of this paper, or our agency as individual actors, I describe alternative ways of thinking, doing and building that seek to provide innovation value to people within the limits of the planet. It situates these ways of thinking and acting as primal,

and subordinates growth to the level of epiphenomenon--something that start-ups do, or an unintended effect--rather than the nomothetic goal of all economic activity.

Perhaps we should simply adopt a human-centered perspective, rather than a growth-centered one, in order to attain our clear and obvious implicit goal of a thriving economy?

## **HUMANS CANNOT BE THE CENTER**

Many EPIC members work in the design or technology industries, where human-centered design process are integral to developing the products and services upon which our firms depend. Human-centered design emphasizes empirical humanistic research as the starting point for creating products and services that are designed to serve customer/user desires. While it is prudent to emphasize end users' needs when considering technology development (Cooley 2016), our collective design process might already be overly human-centered. Aside from technology and humanity, all most other considerations are excluded from the design process. This occurs in large part because such externalities do not factor into our current pallet of economic incentives.

Other inhabitants of the biosphere are increasingly marginalized, taxed or exterminated. Today the biomass of humans and their mammalian livestock ( $\approx 16$  Gt C) far surpass that of wild mammals (.007 Gt C), while the same is true for poultry (.005 Gt C) versus wild birds (.002 Gt C) (Bar-On et. al. 2018). As humans and domesticates have outcompeted other species, species extinction rates have already exceeded 1,000x likely background extinction rates, which have pre-historically roughly equated to speciation rates (Pimm et. al. 2014). Further exponential increases in extinction are expected, as geometric increases in human economic activity have been associated with ongoing extinction events. Even for extant species, considerable population losses portend an ecological limit to human expansion. To wit, oceanic phytoplankton, the base of the aquatic trophic pyramid, have been declining in reverse proportion to pollution and economic growth (Boyce et. al. 2010). Their loss is problematic because they create  $\sim 50\%$  of the organic matter on Earth and emit  $\sim 50\%$  of the oxygen. Without a self-sustaining population of phytoplankton, the productivity of continental shelves would be much lower. This decrease is directly caused by various sorts of human-made pollution, both run-off and atmospheric. There isn't enough room for humans and for microbes.

As the previous section alludes, present levels of human economic growth increasingly come at the expense of important support systems of the biosphere. A glaucomic focus on human needs obscures and enhances well-documented externalities of our system of production.

In that human-centered design is primarily focused on meeting human needs with the goal of driving use and adoption of a product or service, it is ideologically complicit with the unsustainable growth paradigm outlined above. Human centered design emerged in a time when the needs of corporations, governments or the technology itself was given primacy over the present needs of the humans making or living with the product or service (Cooley 2016). Human-centered design is an unquestionable step in the right direction over machine-centered design. Although the human-machine conflict is not yet entirely resolved, human-centered design is insufficient to provide for a thriving world populated with technological, non-human and human actors.

While human-centered design is effective for designing more effective products and services, it fails to effectively address the social and ecological impacts of its services and technologies. For instance, let's take a hypothetical example of a technology ethnographer working for an ecommerce company. She interviews participants, most of whom are dissatisfied with shipping times and porch theft. She analyzes the results and facilitates a workshop to ideate solutions to the problems she identified during her studies. The team posits that delivering packages with drones during evening hours is a parsimonious solution. The packages are delivered when users are at home, often at least 12 hrs before they would be delivered otherwise. Moreover, the technology does not require that delivery people work after-hours, away from their families. Even better, the drone technology is inexpensive to operate, so the e-tailer's profit increases. A pilot in densely settled, suburban Silicon Valley is encouraging. Yet in the world beyond the product manager's spreadsheet, high levels of crepuscular drone traffic disrupts the local bat community at key feeding times, leading to lower populations. Lower bat populations lead to higher mosquito populations in the freshwater creeks that drain into the South Bay. Higher mosquito populations tempt local governments to control the problem with pesticides, which filter into the Bay and have further unexpected, negative entailments within its estuarial ecosystem. In the end, the firm launches the drone delivery program. It gains market capitalization, increases revenue and grows its user base.

Yet, because of humans' propensity for shifting baselines, end-users are no happier. In the end, requiring that they wait half a day for a package or get reimbursed for a new one was not a real drag on their ability to thrive. However, the new baseline of expectations remains while the bat population doesn't come back and the insecticides remain in the bay.

In this scenario, the firm and product team responsible for the drone pilot program have designed an effective human-centered intervention that would be a complete success by most standards. Yet their product has not measurably contributed to human thriving. Worse, it has several negative externalities associated with it. This kind of product is an example of innovation without progress. It is precisely the type of product error to avoid in the 21st C economy.

Humans are appropriately the center of our worlds, but we are not the central hub of Earth's functioning as a whole. Paradoxically, the human center cannot hold if humans are the only focus of the design process.

## **TIME FOR A REDESIGN: HOW MIGHT WE ETHNOGRAPHERS\_\_\_\_\_?**

Because economic systems help to establish the conditions under which businesses operate, the growth model has profoundly influenced the way products and services are designed. Technological innovation is nested within the economic matrix in which it occurs. Therefore, most of the technological innovation to which industrial ethnographers contribute is either implicitly or explicitly in the service of growth. Yet, as detailed in the first section, total economic growth may not continue to be to our collective advantage to the extent it was in the past.

This conundrum is a powerful example of the narratives, technologies and rules which people have created exerting undue agency over the creators of those cultural objects. The things we have made are now making us instead of vice versa. In his Right Livelihood acceptance speech in 1981, technology philosopher Mike Cooley stated, "Science and

technology is not given. It was made by people like us. If it's not doing for us what we want, we have a right and a responsibility to change it." (<https://www.rightlivelivelihoodaward.org>) Cooley's enjoinder reminds us both of our created system's power over us, and that we are its original architects--we have the ability to change what we've created if those things no longer serve the purposes for which they were intended.

We need a solution that holds a balance between technology, human society and the natural world. This paper explores how we might design products and services that account for the needs of all users (including bats, for instance) within the means of the planet. First, I explore how we can conceptualize alternative goals by theoretically emphasizing the holistic, systems approach to the economy. This section begins by defining donut economics. It points out that such an economy exists in a sort of dynamic equilibrium, much like most ecosystems do. Such an economy in dynamic equilibrium might borrow more processual understanding from the complex nested interrelationships of ecological models, rather than the rational, exponential functions of 20th century economic theory.

Second, I explore service design and permaculture design as repositories of ideas that could be used to form a research framework to aid design for those designing within the 21st century's constraints. Service design provides a useful starting point for thinking about how we might design a system that functions in a sufficiently holistic way to address systemic, complex, interrelated issues. Ethnographers in industry are uniquely positioned to affect the design. Ecological design, specifically permaculture (a sustainable agriculture design paradigm that emphasizes ecosystem mimicry), has developed a system-level approach to designing productive landscapes in the image of productive ecosystems. This design system focuses on empirical observation to identify the relationships between the component pieces of the design.

Third, I explore how we might gather and apply our findings to illustrate appropriate focus points for our teams. While human-centered design has been and will continue to be an effective tool for designing viable technological solutions, I build on its foundation to introduce donut-centered design (Raworth 2007)--a frame and method of design that considers humans within their eco-sociotechnic reality and designs for their relationships to one another and the environment. Improving these relationships is, strictly speaking, growth agnostic.

## THE DONUT ECONOMY

We made the growth economy, so we can unmake and replace it. Where as a growing economy has generally, in the 20th century, been synonymous with a thriving economy, the same may not be true in the 21st century. A growing economy can be an unequal, destructive one, while a thriving economy may be growth agnostic. Although many potential alternatives to a growth-oriented economy exist, this paper pursues the idea of donut economics (Raworth 2017), an economic construct that emphasises a balance between social and environmental outcomes, while remaining inclusive of other alternative approaches (*e.g.*, circular economy, solid-state economy, b-corps). "Doughnut Economics" describes the pressing contemporary need for a type of economy that addresses human aspirations within environmental bounds: "Humanity's 21st century challenge is to meet the needs of all within the means of the planet. In other words, to ensure that no one falls short on life's essentials (from food and housing to healthcare and political voice), while ensuring that collectively we

do not overshoot our pressure on Earth’s life-supporting systems, on which we fundamentally depend (<https://www.kateraworth.com/doughnut/>).”

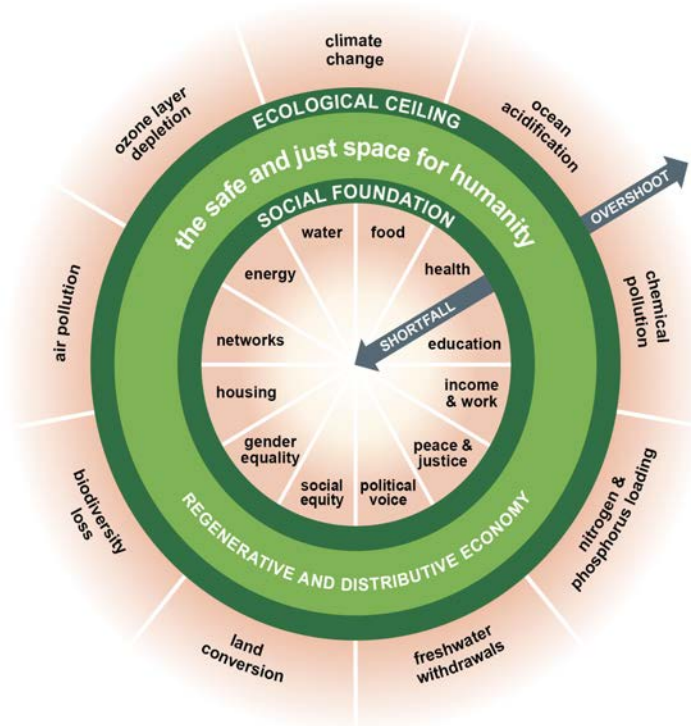


Figure 1. The Donut of Donut economics.

[https://en.wikipedia.org/wiki/Doughnut\\_\(economic\\_model\)#/media/File:Doughnut-classic.jpg](https://en.wikipedia.org/wiki/Doughnut_(economic_model)#/media/File:Doughnut-classic.jpg). Creative Commons.

The donut itself, like the hockey-stick exponential growth curve that preceded it, is a useful metaphor for explaining the goal of a system. The inner circle of the donut represents a “social foundation”, below which individual want becomes systemic shortfall (see Figure 1). In this space, the “pie” is divided among metrics intended to characterize how well humanity is serving its own needs. Key performance indicators include food and water availability, public health measures, levels of political violence, social inequality of various sorts, public education, and energy availability. The outer circle of the donut represents the ecological ceiling, beyond which humanity over-taxes its biospheric support systems. In order to measure the types and levels of overshoot, Raworth offers the cycles of key chemicals such as nitrogen, carbon, phosphorus, o-zone, freshwater and various pollutants, as indicators of ecological performance.

Ultimately, the steps that Kate Raworth outlines boil down to a single enjoinder: treat the economy like the ecosystem it is, rather than like a single mathematical function, which it cannot be. In order to shift the economy from its present form toward the donut, Raworth outlines a seven-step program that is worth recounting briefly in Table 1.

**Table 1. Seven ways to think like a 21st century economist. Adapted from Raworth 2017**

	<b>Mindset</b>	<b>Description</b>
1	Change the goals	Growth as a single economic marker is a poor indicator of social or environmental thriving.
2	From the self contained market to the embedded economy	Selectively examining the market, while ignoring externalities, results in a distorted, narrow view of what the economy is, what it does, and how it should be managed.
3	From the self contained market to the embedded economy	A more holistic lens on what the economy is reveals the wide ranging effects that the exchange of goods and services has on society and the environment. Such a framing is both more accurate and more actionable than the present framing.
4	From mechanical equilibrium to dynamic complexity	Replacing economic models of equilibrium with a systems approach helps researchers, business leaders and government officials conceptualize the global cascade of causes and effects that drive the 21st century economy.
5	Distributive by design	Re-designing the economy to create greater equality without the need to actively redistribute gleanings from growth-driven could be more efficient and effective.
6	Regenerative by design	Re-designing the economy to include, rather than extract from, the relationships humans have with the natural world, allows for business models that benefits and thrive on the inherent regenerative power of the biosphere.
7	Toward growth agnosticism	With other metrics and design practices in place, growth becomes a secondary concern, reserved for new ventures aimed at taking market share from incumbent actors.
1	Change the goals	Growth as a single economic marker is a poor indicator of social or environmental thriving.



2	From the self contained market to the embedded economy	Selectively examining the market, while ignoring externalities, results in a distorted, narrow view of what the economy is, what it does, and how it should be managed.
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If we examine the typical *modi operandi* of most corporations, we see that the goals of the economy at large are mirrors at the individual corporate level. In Raworth's plan for transformation, the word design appears more often than economy. In this sense, the problem of infinite growth on a finite planet is less an economic problem (mainly because economists seem to lack the tools to conceptualize the problem and conceive solutions), and more of a design problem. The purpose of the system was misidentified and, as a result, the possible components were arranged in a way that optimizes for a tangential outcome.

Since the values of the larger economy trickle down to the individual actors and components of the system, it we have an opportunity--as applied ethnographers--to exert change by researching and advocating for rearranging the people, infrastructure, components, metrics of the system through research and advocacy. In other words, our companies are also optimized for the wrong thing in their efforts to match the bars set by traditional economic reporting. Below I outline the ways in which contemporary corporations fail to meet Raworth's enjoinders.

## Change the Goals

Most companies operate with growth as their king metric. Profits can be deferred, as Amazon and Uber have shown (<https://www.nytimes.com/2019/04/28/technology/uber-amazon-roadshow-ipo.html>). Environmental concerns can be minimized, as numerous firms have demonstrated. Social concerns can be circumvented, as firms from US Steel to Facebook have shown. But at all stages of the corporate lifecycle, growth is non-negotiable. At the start-up phase, growth and adoption are critical. Additional growth is necessary to provide a stable economic foundation for the firm to go public. After the IPO, the firm is beholden to stockholders who demand a return on their investment, which is largely dictated by perceptions of value driven by consistent growth metrics.

## From the Self-contained Market to the Embedded Economy

Firms generally measure their impact in narrow terms, such as number of users, profitability or similar growth-oriented metrics. Sometimes, firms will selectively target certain metrics in order to be viewed favorably by consumers or regulators. The end result is a viewpoint of the company or product's impact that is equally narrow, or simply a window-dressing.

## From Mechanical Equilibrium to Dynamic Complexity

The manner in which mechanical equilibrium plays on the company level is largely in the quarterly goals set out by venture capitalists or stock-holders. These temporally narrow

check-ins assume a system that is rarely in flux. This assumption is seemingly further supported by the reasoning in the “self-contained market” headline.

### **Distributive by Design**

Designing for distribution involves changing incentives to align them with the goal of distribution and uptake. In many cases, this is revolutionary because it counters the typical framing. For instance, when Henry Ford increased minimum wage, it was widely condemned for reducing margins. However, in practice the move created a workforce that could afford the product it was manufacturing. Similarly, many companies are beholden to margins, users, page-views or other metrics and are unwilling to think creatively about how they might benefit from transgressive thinking.

### **Regenerative by Design**

Similar to designing for distribution, designing for regeneration is something that is not only transgressive, but also beyond the skillset of most people in the position to elicit change. Beyond sustainability, regeneration is a concept so foreign that it is difficult for companies in the capitalist framework to first envision, and eventually embody. Farmland LP (<http://www.farmlandlp.com/>), an investor in regenerative land conversion, has become an exception that proves the rule by using the regenerative capacity of the land it purchases and conventional farms it converts to organic ones in order to provide a return for investors.

### **Toward growth Agnosticism**

Together the thought of a company being growth agnostic is currently ludicrous. If it exists, it remains unspoken. During the period of time when Amazon was not profitable, the justification for its high valuations and continued line of credit was its growing user base (<https://www.forbes.com/sites/lensherman/2019/05/06/uber-should-be-judged-on-its-own-merits-not-amazons/#6ad487fc1fc3>). The idea of a growth agnostic company attracting people and resources seems unthinkable within the current economic design schema.

## **FROM SERVICE DESIGN TO DONUT DESIGN**

To conceptualize the economy within the donut’s confines changes the goals of the design process. Thus, the design process itself differs from its current instantiation. Rather than focusing exclusively on growing the market share and adoption of a particular offering, the goal of the design process is to contextualize the offering socially and ecologically. Many approaches that would facilitate this shift are already in practice, but simply not utilized on the same projects. On the one hand, service design has expanded the range of design praxis to include all aspects of human service (Stickdorn et. al. 2011). On the other hand, ecological design has emphasized embedding built systems in ecological context (Bane 2012). I propose synthesizing relevant elements from both service design and ecological design to create a

flexible, processual design tool for the 21st century economy-- donut centered design. In order to understand this gravid hybrid, let's first examine its parentage.

## Service Design

Service design grew out of the human-centered design movement, which aimed at using technology to serve the needs of people, broadly stated (Cooley 2016). However, it broadens the object of design from technology itself to the entire constellation of parts necessary to produce a product or service. Formally, service design involves arranging, infrastructure, communication and material components of a service in order to improve its quality and the interaction between the service provider and its customers (Hollins and Shinkins 2006). Service design traces its roots to the human-centered design movement, mentioned above, but expands its sphere of influence. Human-centered design grew out of technology design within the field of human-computer interaction; thus it emphasizes the discrete relationship between a technology and its users. By contrast, service design examines all aspects of an offering, both internal and external to the organization providing the offering. Moreover, it examines the social matrix in which it interacts. Because of its wider aperture, some practitioners have begun to apply service design to social development or governmental contexts (Stickdorn et. al. 2018). This application of service design--to the arena of social impact--is of particular interest to the formulation of donut centered design, for it's aim to create a social foundation.

Service design is a holistic design practice, starting with systematic qualitative research (often ethnography) with the goal of arranging people, things and information in ways that serve end users. Following cycles of iteration, testing and refinement, the end result of the methodology is to create a holistic, actionable representation of the service.

However, a deft reader will notice that the foci of service design--people, infrastructure and material components--are very anthropocentric. Service blueprints, the tangible deliverables of the service design process, often divide the service into spheres that are visible to the customer and those that aren't. Yet it does not often take into account the often invisible effects of pre-service supply chains or post-service consumptive waste. In order to more fully account for the systemic effects that occur during raw material sources and after service disbursement, I recommend adding additional layers to the typical ones found in a service blueprint. Typically, service blueprints include customer, front-stage and back-stage actions and processes. The additional layers necessary for a donut-centered design approach would include what happens as a result of the customer journey in the larger ecosocial context. Does the service encourage frivolous consumptive behavior? Or does the service make it easy and enjoyable to consume less (Lockton et. al. 2012)? On the other side, behind the backstage is the supply change, with its local embedded contexts. Does the design of the service take into account the effects of people, infrastructure and resource movements along its entirety? Are people fairly remunerated? What are the ecological effects that are typically deemed externalities, or rolled into the "cost of doing business"? A donut-designed service blueprint captures and examines these facets, whereas one that is simply human-centered does not.

In fact, service design can be used to make services ephemeral or addictive, thus compelling users to be complicit in a service that goes counter to humanity's greater good, at either the social or environmental level. Indeed, unless the service design project is directly

aimed at sustainable outcomes, it would be easy for the method to miss the other component of the donut--staying under the ecological ceiling.

## Ecological Design

Ecological design is a method of design that emphasizes the ecological footprint of goods and services. Said another way, ecological design fully contextualizes the materials and processes used to create a product or service within biospheric systems. Ecological design has grown independently out of sustainability studies, agriculture and industrial design. For the purposes of holistically addressing the need for the donut centered design process to maintain numerous systems within their operating capacity, the radical sustainability of permaculture design is preferable to approaches that slightly modify current ones.

Permaculture was originally intended as a sustainable, that is permanent, agricultural system based on mimicking the ways ecosystems operate. In the decades following its original conceptualization by Mollison and Holmgren (Mollison 1988), permaculture designers have codified a loose system of principles for creating functional designs that are effectively and sustainably embedded within their local ecological contexts (Bane 2012).

**Table 2. Permaculture Design Principles**

	Principle	Description
1	Observe and interact	By taking time to engage with nature we can design solutions that suit our particular situation.
2	Catch and store energy	By developing systems that collect resources at peak abundance, we can use them in times of need.
3	Obtain a yield	Ensure that you are getting truly useful rewards as part of the work that you are doing.
4	Apply self-regulation and accept feedback	We need to discourage inappropriate activity to ensure that systems can continue to function well.
5	Produce no waste	Make the best use of nature's abundance to reduce our consumptive behavior and dependence on non-renewable resources.
6	Use and value renewable resources and services	By valuing and making use of all the resources that are available to us, nothing goes to waste.

7	Design from patterns to details	By stepping back, we can observe patterns in nature and society. These can form the backbone of our designs, with the details filled in as we go.
8	Integrate rather than segregate	By putting the right things in the right place, relationships develop between those things and how they work together to support each other.
9	Use small and slow solutions	Small and slow systems are easier to maintain than big ones, making better use of local resources and producing more sustainable outcomes.
10	Use and value diversity	Diversity reduces vulnerability to a variety of threats and takes advantage of the unique nature of the environment in which it resides.
11	Use edges and value the marginal	The interface between things is where the most interesting events take place. These are often the most valuable, diverse and productive elements in the system.
12	Creatively use and respond to change	We can have a positive impact on inevitable change by carefully observing, and then intervening at the right time.

*Adapted from Bane 2012*

A reading of the listed permaculture principles reveals similarities with service design. Importantly, both permaculture and service design seek to arrange the components of system based on extended observation such as to achieve a systemic result that could not be had without such an arrangement. Principles 1, 3, 7, 8, 10, 11, 12 read as though they could just as easily be lifted from a service design manual. First of all, both utilize empirical qualitative research as a foundation for action. This penchant for observation lends itself to ethnographers who aim to increase their agency through applied practice. Service design and permaculture design both create ways for the enterprise to earn it's keep by obtaining a yield. Permaculture's use of the word yield, rather than profit or growth, is useful. Like permaculture, many service design principles apply across industries, allowing service designers to use broad patterns as starting points for the design of novel solutions. Regarding principle 10 and 11, valuing diverse, marginal participants has been an important component of service design firm IDEO's strategy for at least a decade. Similarly, voice assistant technologies originated from researching and meeting the needs of people who do

not access technology in typical ways. Principle 12 is taken for granted for firms operating in the digital age.

However the opportunity to expand service design practice with methods and principles from ecological design lies in the area of non-overlap. Only niche service designs operating for sustainability-conscious companies would have much familiarity with concepts of catching and storing energy, producing little waste, using renewable resources, and minimizing impact. Some examples exist. Heineken has applied concepts from circular economy thinking to some of its plants, making at least one entirely self-sufficient using a circular (not to be confused with donut) economic approach (<https://www.fastcompany.com/40536868/this-brewery-is-designed-as-a-model-for-the-circular-economy>). However, projects such as these are typically the province of sustainability experts, not service designers. To design for the donut economy, there needs to be a process that embodies both the embedded creation of products for people, within society, within the already overtaxed means of the planet. Enter donut centered design process.

## **THE DONUT-CENTERED DESIGN PROCESS**

Thus donut centered design is the evolution of service design to include an assessment and arrangement of a broader set of constituent components. It is an even greater departure from the history of design as the creation of objects with a purpose, to the creation of a system with a purpose. Rather than creating an object, it thoughtfully creates a socioeconomic assemblage within the biophysical environment. With this larger framing as the goal of donut centered design, how might product strategy and design teams execute projects toward it? Specifically, how might industrial ethnographers provide strategic guidance in the course of donut centered design?

As mentioned previously, ethnographers possess arguably the most holistic social scientific skillsets present in the UXR/Service Design community. Ethnography emerged from a peculiar need that anthropologists had--to enter a new culture embedded within its environment and make sense of it. Thus, ethnography was initially implicated in tracing kinship, elucidating rituals and ascertaining subsistence patterns. In many regards, the same ethnographic skillset is needed for donut centered design. Many of the relationships, rituals, and modes of extraction are unknown-unknowns in the service creation process.

Despite the familiarity of base method of ethnography, donut centered designing would likely proceed differently than product or service design processes in which most EPIC ethnographers are embedded. Unavoidably, the object of research is more extensive. It is not simply a user/consumer, her immediate network and connection with a product. Rather the object is the holistic system that will be altered by the new product. Thus, research is more extensive, and work products and measures of success differ from other development processes.

### **Site-Assessment**

Site-assessment is the first thing that permaculture designers do. When they are contracted to design and implement a plan, they first conduct a thorough evaluation of the

sites' ecological components. This involves mapping resource flows, testing soil and emissions, analyzing local climate data and conducting an inventory of plant and animal species. While some of these techniques will apply to donut centered design, the idea of the site, and thus the site which is being assessed, must be expanded. A traditional site assessment is necessary but insufficient for the task.

For instance, how does one conduct a site assessment for an app? This would involve the physical locations of the headquarters, the supply chain, the communities of eventual use, and the physical bodies of users. It would also involve the effects of the product on the environment surrounding the relevant actors and the way their agency changes with the new product in hand. A standard site assessment is a good start, but like a single anthropological fieldsite, it fails to account for the empirical linkages among dispersed but connected phenomena, as are so common in the globalized world.

### **Tracing Associations and Multi-Site Ethnography**

Techno-globalisation of the world system called for a different anthropological approach to understanding human cultural phenomena. As anthropologists transitioned from studying cultures in embedded localities, they began exploring multi-sited ethnography as a technique of understanding (Marcus 1995). Derived from actor-network theory, multi-sited ethnography is aimed at understanding the relationship between culture, entities and values by analyzing flows--tracing associations (Latour 2006). Business anthropologists have noted that "in tracing associations, tracking flows, and detecting linkages – also opens up ways of avoiding tendencies to essentialize culture and values. The articles in this volume all testify to this possibility. A focus on the relational, social dimensions of business and exchange – of the making of value in social processes" (Morean and Garsten 2013). Notably, permaculturists trace associations and focus on flows more than on particular plants, animals, or other environmental features. The focus of each is a holistic understanding of the way things are arranged to compile a whole, rather on the inner workings of subsets. While actor-network theory is too large a subject to cover here, it provides the methods and theory for conducting anthropological ethnography of supply chains, technology and dispersed systems that is so necessary for designing in the donut.

### **Multispecies Ethnography**

In parallel to multi-sited ethnography's focus on dispersed, yet powerful cultural phenomena, multi-species ethnography has started to account for the relationships of humans to actors and forces that have previously been marginalized by anthropology. "A new genre of writing and mode of research has arrived on the anthropological stage: multispecies ethnography. Creatures previously appearing on the margins of anthropology—as part of the landscape, as food for humans, as symbols—have been pressed into the foreground in recent ethnographies." (Kirskey and Helmreich 2010) This development matters for the donut centered designer embedded within industry because the same cultural assumptions about the separate-ness of plants, animals and natural features from human culture is being called into question. Understanding the empirical, qualitative relationship between humans and non-human actors is critical to understanding ourselves. Animals, plants, fungi, and microbes once confined in anthropological accounts to the non-human

zone, are now being included. Turning the lens of ethnography on animals, plants, fungi or the nonliving components of the biosphere is surely a departure--to the extent that ethnography denotes an exclusively human focus. Yet, humanity is so intimately intermingled with its inter-species relationships that this departure seems appropriate for those designing the anthropocene. Multi-species ethnography as step of the donut-centered design process is to locate the features of human activity in the natural realm, not just the cultural one.

## **Bringing it Together with the Ecosocial Service Blueprint**

Following site assessment, tracing associations and multi-species ethnography, the findings and insights of the donut centered research process must be made available to teams of stakeholders. For permaculture designers, the primary work product is the site map (Bane 2012), while for service designers, the service blueprint is a common deliverable (Stickdorn et. al 2011). I propose incorporating elements of both into a master plan called an ecosocial service blueprint.

Service blueprints generally include the people, processes, services and products of a business arranged in a way that makes their inter-relatedness apparent. A common way of visualizing this arrangement is to depict a user journey, with physical evidence and interactions flanking it. The interactions are grouped by those that actually touch users, ones that are visible, and ones that are invisible, but still within the confines of the company's walls. An ecosocial blueprint expands the aperture. On the upper side, the sourcing and ultimate fate of the physical evidence is tracked, along with its immediate relationships. The user's journey contains what might happen personally, socially or communally if many of these journeys are completed. On the bottom side, the ecological and social impact of the company's internal operations appear as a foundation, thus cataloging effects that were previously invisible externalities. This an ecosocial blueprint takes cues from the traced flows and carefully placed elements of permaculture site maps and service blueprints into a master plan which hypothesizes the flows (essentially causes and effects) in a whole systems matter.

While ethnographic research and market assessments provide excellent starting material for an ecosocial blueprint, it is unlikely that ethnographers would possess the various expertises necessary to ideate and craft a plan. In both permaculture design and service design, teams of multi-disciplinary co-creators tend to make the most innovative, most durable designs. This holds even more true here, for without people who know about customer service, product design, sustainability, technology and research a realistic master plan may not be achievable. Many individual methods for ideating and designing services exist and would be useful for creating and implementing an ecosocial design. Many methods would remain nearly unchanged, and therefore are beyond the scope of this introductory article.

## **Holistic Metrics**

After developing a plan, how will you measure success? This returns to the fundamental charge of the donut--growth is essential and good, but perpetual growth is not. As much or more than research and design, target metrics can drive strategy and decision-making. Most ethnographic practitioners are aware that tethering goals to metrics can be a powerful behavioral motivator. In many large organizations, annual goals trickle down through



departments to teams to individuals, where quarterly performance goals operate as microcosms of annual corporate goals. Salaries, bonuses, promotions and retention are often calibrated to these goals. Thus, they heavily influence individuals to achieve relative to chosen metrics as the expense of other metrics. A similar phenomenon operates on the national and international level--when GDP (or stock market indices, another growth-centric indicator) is fetishized and pursued at the expense of other metrics. Thus establishing desirable metrics is an integral part of donut design.

While perpetual growth is not an effective metric, proposing other metrics can be fraught with debate. Any metric can be subject to reification and maximization, at the expense of a more holistic assessment. However, metrics are necessary to track progress and make decisions. The donut describes some physical and social measures that can be useful, but often may not apply to a product or service.

Indeed selecting which metrics are relevant will depend heavily on the particular design, as well as the maturity of the firm producing the product or service in question. The emerging field of social impact metrics seeks to define standard or custom metrics to track progress and change that organizations effect. Establishing relevant metrics that map to the mission of your organization, as well as the resource and interaction flows in the ecosocial blueprint, is largely a custom, iterative process, rather than a one-size-fits-all approach. Yet despite the contingency of social impact metrics, defining metrics changes the goal of the system, and is thus unavoidable for designing for the donut--itself an alternative set of goals set in place of totalizing perpetual growth.

## **WHERE TO START?**

Like the scale of the problem, implementing a solution can seem like a daunting, even futile, task. This is especially true if you are a sole actor within a large corporate apparatus that is not aligned with the ideas or ideals of donut centered design. For those working in a service design capacity already, begin by conducting the research outlined above and assembling an interdisciplinary team of designers. Proceed from research, to ideation, to co-design, to metrics selection, iterating recursively as needed. An excellent starting point is the application of the permaculture design concept of zones to your professional life. In permaculture, zones are used to represent the level of intensive management of a feature or area. Zone 0 is the living area. Zone 1 contains that which is used daily, like an herb garden. Zone 2 contains features that are visited every few days, like a patio. Zone 3 contains features that are visited weekly, and Zone 4 monthly. Zone 5 is totally wild area. As an ethnographer, you can determine which areas of practice you touch daily, weekly and monthly. Your influence on the design of those areas is highest in Zone 0 and least in Zone 4. You can change what you are habitually tasked with creating, so beginning in the highest zone of agency is a way to effect change immediately. We all have some agency in our lives, and in the workplace, to practice donut-centered design.

## **CONCLUSION**

The theme of EPIC 2019 is agency. The conference theme asks, "What does it mean to have agency in an increasingly automated world?" I would argue that the world has been

automated for longer than digital technologies have been automating it. Our economic systems and their components are automated--designed--for growth via extraction. The fundamental question of agency is then, "do we have agency to determine the goals of an economic system?"

Economic systems include the ways that societies derive subsistence, protect themselves from threats, create infrastructure, solve problems and pass on culture. In the anthropological literature, some societies grow rapidly (like the Mongol Empire), while others do not (!Kung Bushmen). All must have grown for a period of time. Most have collapsed and no longer exist. Growth is certainly not a given. In fact, it has only ever been a phase through which societies pass before reaching equilibrium or going into decline. Is it within our collective agency to reflexively determine when the growth stage of a product, business, sector, corporation, region, country or species is over and equilibrium stage should be considered the ideal in place of growth? To answer in the negative is disempowering, while to answer in the affirmative smacks of centralized planning. To abstain is to wait for environmental limits, intra society competition or crippling complexity to curtail growth "organically."

However, the stakes could not be higher. Regarding the ceiling of the donut, many of the natural resources, living and nonliving, used to stoke growth are non-renewable. As for the donut's social floor, the negative outcomes and externalities of perpetual growth are disproportionately felt by marginal or disempowered members of global society. Not only this, but the structures of power and production exert overwhelming inertia to change.

In a narrow individual sense, most of us have little agency to pursue professions that are growth agnostic. The structure (typically the yin to agency's yang) of businesses within the economic system is so rigidly prescribed that alternatives exist only on the margins, though this is changing in part. An illustrative case of agency and change comes from the story of digital marketplace Etsy. When Etsy began, its founders incorporated as a B-corp, a corporate structure that places social and environmental value as the heart of a business's decision making process, and is designed to protect the values of the firm from the wishes of shareholders in the event that the company goes public. Etsy was one of the first companies to conduct a public IPO as a B-corp in 2015 (<https://qz.com/work/1146365/etsy-made-mistakes-from-which-other-b-corps-can-learn/>). Its IPO was mixed, and eventually, due to the pressure to generate shareholder value, Etsy allowed its B-corp certification to lapse in 2017 (<https://shift.newco.co/2017/11/27/why-we-need-more-etsys/>). Etsy's story illustrates that a company can be conceived, designed and grown while retaining a commitment to people and planet. Yet it cannot be grown indefinitely without subordinating those concerns to profit. In essence, the design of publicly owned corporations, whose valuation is assessed by the millisecond, and whose growth goals are rolled over quarter to quarter, is antithetical to the agency a company (or the people within it) .

Etsy's story also illustrates the potential agentive power of various groups to enable future outcomes to diverge from past outcomes. To apply the service design lens to Etsy, they existed in a web of associations with consumers/users, communities of practice, shareholders, governments, the physical environment and other corporations. Like the resource flows that permaculturists track, the flows of power in and out of Etsy reveal a design that caused them to compromise their values. Coerced by stakeholders, alienated from their consumer/community base, and replicated by competitors like Amazon, Etsy was forced to compromise.

But as always, individual agencies conspire to collectively remake outcomes. Other B-corps (e.g., Patagonia, Allbirds) have not gone public, but continue to be vibrant and profitable. Users and communities want to patronize firms with good ethics. Some governments are passing legislation to incentivise socially and environmentally responsible businesses. Talent wants to work for them. Thus, a service design process that focuses on people and planet is a critical feature of a currently forming future. Importantly, donut-centered designers (ethnographers) are crucial for such a production process.

In conclusion, the social and ecological challenges of the 21st century require a design process that matches viable economic solutions. I've proposed donut centered design as a hybrid of service design and ecological design, with an emphasis on how private and public sector ethnographers can serve to weld the best of two processes by providing a holistic, empirical research foundation. From the research foundation, it becomes possible to change the KPIs that organizations use to guide their actions and establish their successes. Rather than employing human-centered growth as a measuring stick for success, the donut economy with its goldilocks optimum above the floor of social impoverishment and below the ceiling of ecological overshoot provides a novel beacon for action. When they founded Google, Larry Page and Sergey Brin installed the phrase "Focus on the user and the rest will follow" to imbue the nascent company with the customer focus necessary to win search market share and achieve success. To adapt the words of Google founders for a new century of technological innovation, perhaps instead of focusing narrowly on the user needs to guide out endeavors we should focus on the nexus of society and environment. "Focus on the donut, and the rest will follow."

**Christopher Golias**, Ph.D. is a technology ethnographer, currently with Google, who has conducted applied anthropological research across various areas including retail, healthcare, indigenous rights, substance use, ecommerce, governance, machine learning, localization and information technology. He holds a Ph.D. in Anthropology from the University of Pennsylvania.

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