

# EPIC2020

Ethnographic Praxis in Industry Conference

CATALYST

## From the Space Station to the Sofa

### Scales of Isolation at Work

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*Since March 2020, many employees around the world have been forced to work from home due to the COVID-19 global pandemic. Astronauts aboard the International Space Station (ISS) have experience in working in isolation and confinement. This paper focuses on a comparison of astronauts on the ISS and Earth-bound architects and interior designers restricted to working from home (i.e. their sofas) due to the pandemic. Isolation at work emerges as a complex phenomenon characterized by the measured and perceived distances between physical, social, and temporal spaces. By examining the scale-making activities of NASA and HKS, analogs provide a possible means for studying and predicting the complex dimensions of isolation. The work ecosystem is a useful tool in conceptualizing and operationalizing the employee experience to design the future of work and workspaces.*

In 2020, the global workforce has become distanced in ways that no one could have imagined. Due to the COVID-19 pandemic, humans around the globe transitioned nearly overnight to working in isolation, confined to our homes, and conscious of the extreme (i.e. contagious) world outside. Leaders and employees in governments, businesses, universities, and organizations of every type are affected by the current pandemic. The sudden, worldwide shift to remote working has prompted many questions about the future of work (FOW) and the concept of work-from-home (WFH). Inspired by the messages from astronauts on the International Space Station (ISS), we consider the 2020 employee experience in two seemingly different industries, space exploration and architecture. Our focus is on a comparison of astronauts on the ISS and Earth-bound employees restricted to working from home (i.e. their sofas) due to the pandemic. The employee experience of working in isolation is contextualized through examples of our respective ethnographic work on workplace design at NASA on the design of space habitats and with HKS Inc., a global architecture firm. From the space station to the sofa, we explore the usefulness of the ISS as an analog<sup>1</sup> for the WFH experience and open up questions of scale, space, place, and time.

### ASTRONAUTS AND ANTHROPOLOGISTS: IN THIS TOGETHER

“From up here, it is easy to see that we are truly all in this together. #EarthStrong,” astronaut Jessica Meir tweeted on March 16, 2020, from the ISS, shown in Figure 1. As COVID-19 spread across the globe, the first messages from astronauts focused on human solidarity. Astronauts are known to share Tweets and words of encouragement during natural disasters, terrorist attacks, and other catastrophes that affect nations around the world. COVID-19 was no different. However, with the sudden shift to remote working occurring worldwide, astronauts began adding words of wisdom to their messages from

outer space. Medical experts and government officials began directing the world on how to live during a global pandemic, and astronauts quickly began sharing their expert tips for working in isolation. On March 21<sup>st</sup>, days after Meir’s first Tweet, retired astronaut Scott Kelly (2020) published an opinion piece in *The New York Times* with the title “I Spent a Year in Space, and I Have Tips on Isolation to Share,” see Figure 2. NASA (2020) followed suit the following day (Figure 3) and published tips from astronaut Anne McClain on its website. Two days later, the *National Geographic* (2020) published an interview with astronaut Chris Cassidy “Stuck in a cramped space? This astronaut has some advice,” shown in Figure 4.



Figure 1. First astronaut Tweet regarding COVID-19



Figure 2. Retired astronaut Scott Kelly's (2020) Tips for Working in Isolation



Figure 3. NASA (2020) posts astronaut's tips for working in confined spaces



Figure 4. Astronaut Chris Cassidy shares tips for working in confinement (National Geographic 2020)

What started as texts between friends, we came together intrigued by the number of interviews, articles, podcasts, and social media posts of, by, or from astronauts and cosmonauts giving WFH tips. As intrigue grew towards intellectual curiosity, we began reflecting on anthropological notions of isolation, work, and scale. As two applied anthropologists from two different industries, we also drew on our respective work experiences and ethnographic research. From a space anthropologist's perspective (Aiken), how does isolation at home compare to isolation in extreme environments? As a design anthropologist working in architecture (Ramer), how alike is the work-from-home employee experience to that of an astronaut? For both of us, as applied, design ethnographers, these questions converge on the subject of scale. How far down, or up, can you scale human experiences of work in isolation? In other words, how comparable are the astronauts' work experiences in isolation to employees working at home during a global pandemic? How useful would such a comparison be? Can you measure, or scale, isolation and work

experiences therein? How do these scales develop in the first place, and how useful are they when it comes to designing the future of work, in space and on Earth? The discussion that follows unpacks these questions and more.

## ISOLATION AT WORK

At first glance, working in outer space seems very different than working from home on Earth; and at the same time, the astronauts' tips for working in isolation during COVID-19 are worthy of international media attention. *Isolation* is the common element that connects these two environments of work in 2020 (i.e. the sofa and the ISS). Simply defined, *isolation* is the condition of being isolated or "set apart from others" (isolate, n.d.). Anthropologists, psychologists, and other related theorists offer insights on what it means to be "set apart" through discussions of space, place, and time (see Low and Lawrence-Zúñiga 2003). Aiming toward practical design application, isolation can be grouped into two categories, or dimensions: *physical space* and *social space*. One can be physically set apart from others as well as socially set apart. Applied, ethnographic workplace studies often address aspects of physical and social spaces (see Cefkin 2010 and Gunn, Otto, and Smith 2013). However, time is a dimension of isolation that is less discussed in anthropology and design research regarding work.

### Physical Space in the Workplace

A practical, even mundane, view of *physical space* focuses on the visible, measurable distances between objects and people in enclosed environments. Physical space can be translated into the volume of a structure and/or the surface of an area. The physical environment and its boundaries are ultimately experienced and evaluated through the body's senses. Bourdieu's (1977) *habitus* suggests the body inhabits an environment that imposes structural constraints, forming dispositions or schemes of perception or thought. Workplace theorists have demonstrated that the perceptions of the physical environment, or office space, directly affects job attitude and performance (Kupritz 2000). Beginning with the first "modern" office space design in the early 19th century, American engineer Frank Taylor sought to maximize efficiency and productivity by designing workplaces based on the design of factories (Kupritz 1998, 2011). Taylorism evolved toward human relations and eventually toward more human-centered design practices in which workplace designs became more individualized and flexible. Over the years, trends in office design have fluctuated from private offices, to open floor plans, to cubicles, benching, assigned seats, hoteling, and hot desking. In outer space, workplace designs are much more limited. However, the design of the ISS also designates specific spaces for work activities that are physically separate from living quarters. As EPIC contributors Imai and Ban (2016) state and most workplace theorists agree, "the physical distance between workers has dramatic impact on productivity and collaboration." The physical environment, then, is a crucial component of understanding the total employee work experience.

## Social Space in the Workplace

Like astronauts, many 2020 WFH employees do not work in complete autonomy. Employees work as part of an organization, department, or team; they have co-workers and a boss. Following our simple view of physical space, *social space* can be described as the perceived distance between people in a given environment. However, unlike physical spaces such as private offices and open floor plans, social spaces are often invisible and immeasurable. As mentioned above, designers consider the physical spaces between members of an organization or team in designing office spaces that promote collaboration and productivity. In other words, physical spaces influence or create boundaries for functional social spaces in the workplace. We create social space, or separate ourselves, from others on the subway by wearing headphones and closing our eyes. The WFH employee appears isolated when his toddler is taking a nap, and no one else visibly or audibly makes a surprise appearance in the virtual meeting. Add in the ancillary layers of the digital realm *and* the added layer of time and we see an even more dynamic view of social space. The act of working outside of standard work hours is an example of creating social isolation, often at the excuse of needing privacy for more focused work. Increasingly, with the invention of the internet, social space has evolved to include virtual spaces that are not geographically based or digitally fixed in time (Miller and Slater 2000). Boellstorff (2015) has taught us to avoid framing the digital or virtual world as “unreal” in contrast to the physical world. Social space, then, exists on measurable scales of the physical as well as in the digital realm of connectedness. When considering the current COVID context, the varying states of social connection in terms of isolation comes to the forefront.

## Temporal Space (or Space in Time) in the Workplace

Time is a complex phenomenon. Here, we refer to *time* as a point of existence measured in units (e.g. hours, minutes, seconds) relative to a given standard. The time in San Francisco is 9:30 AM in the Pacific Time Zone while the time in London is 6:30 PM according to the Greenwich Mean Time (GMT) zone. For this discussion, we consider *temporal space* as the difference in time (as measured, perceived, or experienced) between people and events. At 9:30 AM Pacific, the architect in San Francisco has just begun her workday while, concurrently, the design researcher in London is preoccupied with preparing dinner. In this example, the architect and the design researcher can be engaged in the same virtual meeting, but their experience is different due to the measurable, temporal space between them. Time, though addressed with less frequency and less explicitly in applied workplace research, is a key contextual factor in working in isolation. Astronauts understand that their job requires working in isolation at some point in their careers – once assigned to a mission, they know the start date (i.e. time) their isolation begins. It is unlikely that many architects or designers knew a global pandemic would change their work environment before it happened in 2020. Isolation in spaceflight also has a confirmed end date. Space missions, like polar expeditions, are planned – astronauts know when they are going home. Antarctic scientists say that knowing the last day of the mission was sometimes what got them through the loneliness. In a 2013 habitat study, one NASA scientist shared with Aiken, “If for some reason, your ‘Going Home Day’ changes... some people lose their minds over a 3-day delay.” The scientist went on to emphasize that a change in the extraction date is just as meaningful and



often more impactful on mental health than an extended duration. For many Earth-bound workers, at the time of this writing, it is still unknown when offices will resume normal operations. With no end date and no set duration, the total impact of working in isolation at home during COVID-19 remains unknown.

## **EXPLORING THE USE OF SCALES: ANALOGS OF ISOLATION**

Space scientists and engineers as well as architects and interior designers create and use scales to address the physical, social, and temporal dimensions of workspaces. As seen through two work examples, HKS and NASA experts create and use scales to make tangible and design for the unknown. Tsing (2011:57) uses “scale-making” to refer to projects that create or transform the perception of a scale (i.e. the global) to see how it might work on another scale (i.e. the local). NASA engages in scale-making through the use of local (i.e. located on Earth) space analogs to imagine life on a larger, galactic scale (i.e. not located on Earth). Similarly, HKS views its local architects in a scale-making effort to understand the global WFH workforce – the 2020 sofa is, in a way, an analog for understanding the future workplace experience. NASA and HKS seek to understand and make sense of the dynamic nature of physical, social, and temporal spaces in an isolated workplace. An analysis of these analogs is crucial in assessing the possibility of scaling up the experience of the ISS astronaut to the global, isolated 2020 workforce.

### **Designing Habitats for Space Exploration**

As an applied researcher internal to NASA, Jo Aiken conducted astronaut workplace studies from 2013 to 2018. The first project involved the design of habitats to be used for future missions to Mars. Habitat design is a unique, complex challenge for NASA’s engineers. As humans explore space beyond low-Earth orbit (LEO) new habitability concerns emerge that influence the design of a habitat. Sending humans to work off-planet is costly, so the design requirements also take into account the cost of launching a heavy space habitat. When making critical decisions, space architects and engineers design space systems based on legitimate requirements and not what is simply “nice to have.” To assess habitat design considerations that are more than “nice to have,” Aiken gathered ethnographic evidence about perceptions and behaviors related to living in a Mars habitat. The study provided meaningful insights into previous assumptions made by engineers such as the importance of designing separate spaces for working, eating, sleeping, and exercise. The study also resulted in 25 key findings relating to privacy. Several of these findings provided strong evidence for designing private crew quarters larger than what is currently provided on the ISS – privacy is more than a “nice to have” even when living and working in an environment of isolation. NASA engineers continue to develop the design requirements for space habitats based, in part, on these findings.

Since humans have yet to live on a celestial body other than Earth, it is difficult for engineers to contextualize interactions between astronauts and the technology that is required for living and working on another planet. Aiken, like other NASA researchers, used space analogs to study what it would be like to live in a Mars habitat. Space analogs include simulated missions to Mars as well as science research stations in Antarctica and submarine crews. They use space analogs to scale-back the level of difficulty in studying a future, off-world workplace. Space analogs are located on Earth, yet they mimic to some degree the experience of working in outer space. NASA engineers and scientists refer to the environment of space as Isolated, Confined, and Extreme, or simply “ICE.” NASA researchers use Earth-based analogs to study what it is like to live and work in an ICE environment. They study scientists wintering over in Antarctica to understand isolation and sensory deprivation. They learn about living in small, confined spaces from submarine crews. While nothing can exactly simulate living and working in space, space analogs and astronaut-like populations are characterized by their degree of similarity to the space ICE environment. For example, a simulated Mars mission on the Big Island of Hawai’i is a high-fidelity analog due to the isolated and confined conditions of the participants living in a small habitat. A group of scientists wintering over in Antarctica is a higher-fidelity analog because of the increased remoteness and extreme environment of the region. The ICE scale, on Earth as well as in space, is fluid and changes due to the weather, the sound of a tourist helicopter flying over Mauna Loa, or constant video monitoring by a simulated mission control. NASA uses the concept of ICE to study, predict, and plan for the dynamic nature of social spaces in outer space - ICE influences the construction of space structures, or physical space, as well as the social aspects of space exploration (NASA 2014).

NASA uses another scale to plan for habitat designs at a more micro level than the ICE scale affords. In 2013, NASA asked its scientists and researchers to determine the minimum Net Habitable Volume (NHV), or the minimum number of cubic meters/feet, necessary for supporting crew life on long-duration exploration missions. The NASA behavioral health scientists and human factors engineers recognize the complex, dynamic nature of habitable volume. NHV is what is left available to the space crew after accounting for elements that decrease the usability or functional volume of the spacecraft. For example, the stack of books left in the backseat of my Jeep decreases the NHV available to my passengers. On Earth, gravity reduces the available functional NHV in a given workplace. An interior designer cannot, without assistance and potential harm, work on his ceiling. Astronauts on the ISS can utilize all four walls, or boundaries, of their physical space. In this way, physical space is scaled down on Earth – our available, functional physical space is limited compared to that in outer space. However, NHV or physical space is also easier to scale up in an Earth-bound workplace. A biomedical scientist can go for a walk outside the lab to create physical distance for privacy. The trash is cleared regularly. In space, emptying the trash and creating physical space is more difficult.

### **Designing Workspaces for the Future of Work-From-Home (WFH)**

Working as an in-house researcher for the global architecture firm, HKS, Angela Ramer works alongside architects and interior designers in the design of commercial workspaces on



Earth. Projects seek to scale the human/machine elements to appropriately create the best, most functional built environment and employee experience. This scaling of space for function is known as *programming* in which critical needs are identified and outlined in order of magnitude (e.g. high-level components) or are more detailed (e.g. an itemized list of dimensions, spaces, etc.). Additional affordances are applied for things like assigned seating, meeting/collaboration seats, shared amenity capacities (e.g., cafeterias, auditoriums), as well as code-compliant affordances like parking spaces, distances to entrances/exits, and elevators. Scales, or measurements, can also relate to headcount and occupancy (e.g., building and room capacities) and seating assignments (e.g., individual desks/offices or shared workstations/offices). The most common spatial measurements include Gross Square Footage (GSF), Rentable Square Footage (RSF), and Useable Square Footage (USF). These are interdependent scales used to describe and determine the appropriate allocation of space the results of which are intertwined with facility operations, business goals, human experience, and organizational culture. Similar to NASA's use of NHV, these scales are particularly used concerning function. COVID-19 presents the opportunity for a transformational change in the way architects and interior designers think through and engage with the scales in the post-COVID future workplace.

### *HKS & The Sofa Analog*

As NASA uses space analogs on Earth to test and train for missions in outer space, HKS is in a way engaging the “sofa” (i.e. the home) as an analog to study the office of the future. This approach aims to generate insights to inform organizational operations, real estate, and employee work experience decisions in light of the COVID-19 era workplace. Since March 13<sup>th</sup>, Ramer has been supporting various HKS research initiatives to study the employee experience across the globe. HKS sends surveys at key intervals to track employee experiences regarding mental health, social connections, environmental conditions, work processes, and more (see HKS 2020b). Ramer and her colleagues tracked responses to a core set of questions over time (e.g., desire to continue working from home, activities best done in an office environment, work-life balance, fatigue, etc.). This data was augmented with timely, topical survey questions (e.g., satisfaction with return-to-work protocols, satisfaction with home-work environment). The data from the COVID-era surveys is triangulated with employee surveys collected pre-COVID. Through this continuing process, Ramer and her colleagues seek to identify the social and functional affordances of home-work environments and lifestyle factors previously considered irrelevant in relation work environments. The purpose is to uncover the role that home now plays in the employee experience and to what extent employers need to adapt their policies and spaces to support this fundamental shift in how work gets done.

Findings from the recent HKS studies highlight the significance of work activities within varying scales (i.e. measurements) of connectedness (i.e. isolation concerning social spaces) and the effects of the workplace on our overall health. A factor analysis of the survey data reveals that only two employee demographics are significant predictors of the overall WFH experience – employee age and housing type (e.g. single family home, apartment, etc.) (HKS 2020a). These individual attributes previously regarded as outside the realm of employer consideration are now at the forefront in considerations of organizational policy, culture, and real estate. These attributes have also been found to directly impact the ways and to what

extent isolation is experienced in the WFH context. The HKS studies have found that a sense of connectedness is lower for those who live alone. Likewise, living alone is an indicator of a higher desire to return to the office (HKS 2020a).

In industry conversations, there are many terms related to and sometimes used interchangeably with social *isolation: separation, segregation, seclusion, and insulation*, and more recently *social distancing*, and *quarantine*. Architect and design researcher, Erin Peavy (2020) explores important differences:

Although *loneliness* and *social isolation* are often used in the same breath, the two are distinctly different. Loneliness is essentially the perception of social isolation, whereas social isolation is the absence of regular human interaction in one's life. These phenomena are tied to belonging, trust, social cohesion (the strength of the bonds among members of a community) and social capital (the tangible and intangible benefits a person reaps from his or her social network) as components of our social health, defined as a critical aspect of overall health.

The effects of loneliness and social isolation on occupational health are exacerbated by the current COVID climate where many are still relegated to working from home while many are also living alone. More than 60% of home workspaces are not dedicated or designed as home offices. Employees work from sofas, kitchen tables, bedrooms often alongside their children attending school from home (HKS 2020a). HKS seeks to understand the complex variations of home-work environments, where employee needs are being met, and what is lacking so that employer-provided workspaces can be redesigned to create the best remote and co-located employee experience possible (HKS 2020a). To fully scale up the sofa analog, HKS intends to engage with clients in other industries, share initial insights, and expand data collection to inform the design of future workplaces for other office-based professionals.

### **Comparing Contexts: The Space Station and the Sofa**

The functional differences between scales of physical space in the ISS workplace and the terrestrial workspace are largely driven by gravity and the harsh environment of outer space. While we are physically isolated, or separated, from others by the walls and doors of our homes and offices, a critical point of differentiation is the context in which these scales of isolation are being experienced. Living and working in microgravity is a complex practice that requires years of planning. For astronauts, working in isolation is their desirable end-goal achieved through years of training. Astronauts are not thrown into isolation, or microgravity, on their own. They are assigned to a mission crew, training as a team to minimize the risks of working in an isolated environment. In a 2015 NASA technical report, psychologists emphasized the continued use of training aimed at developing resilience to isolation in crewmembers (Vanhove et al. 2015). NASA provides isolation training through various means, one of which is by sending astronauts to its underwater analog, "NEEMO." They start slowly – NEEMO expeditions last only up to three weeks. NASA also trains its non-astronaut employees. Less than a month before the nationwide stay-at-home orders due to COVID-19, NASA held a mock "stay-at-home day" for its employees. Unlike NASA employees, many 2020 stay-at-home workers did not have the opportunity to set up home offices before orders were in place. Few, if any, spent years of training for working in isolation. For most Earth-bound workers, WFH orders have been unexpected and in many

cases undesired state with the little-to-no period of preparation or training. Table 1 shows a brief comparison of working in isolation during COVID-19, contextualizing the astronauts on the ISS and the WFH experience of architects and interior designers.

**Table 1. Brief Comparison of Working in Isolation During COVID-19**

	<b>NASA Astronauts on ISS</b>	<b>Architects/Designers at Home</b>
<b>PHYSICAL: Location of work</b>	Low Earth Orbit (LEO) Space station habitat	Earth-bound Personal homes
<b>SOCIAL: Work + life</b>	Individual contributors Co-located crewmembers Remote Mission Control teams  Remote family, friends	Individual contributors Remote small teams Remote large teams  ~Co-located family Remote family, friends
<b>TIME: Zones, Scheduling of work + events</b>	Operates on GMT/UTC, Coordinates activities on any given Earth time zone  Experiences 15-16 sunsets every day	Operates on time zone relative to individual location, Coordinates activities with selected co-workers in various time zones  Experiences 1 sunset every day
<b>Type of Work</b>	Scientific experiments/Research Station maintenance Public outreach	Design work Analytical Administrative tasks
<b>Skills/Training</b>	Selected for STEM education and physical fitness 2 years (avg.) of Astronaut Candidate (ASCAN) training +6mo. Mission-specific training	Hired based on architecture education and experience  Continued education for licensing
<b>Tools</b>	Highly specialized equipment designed for microgravity General hardware/software	General hardware/software Assigned, general equipment
<b>Duration (vs. Time, as denoted above)</b>	Intensive, short term missions (currently 6months – 1 year)	WFH efforts, duration currently unknown

## ISOLATION AND SCALE IN THE FUTURE OF WORK

Although the ISS represents an extreme and unique case of isolation in the workplace, scales of isolation in the outer space workplace are useful in thinking through the socio-spatial challenges of working on Earth. Anthropologists and other social and behavioral

theorists can contribute to a greater understanding of isolation at work. Designers with a deeper understanding of these notions can design better workspaces, in space and on Earth. As early as the 1980s, design researchers understood the importance of situating product use in its sociocultural context (Wasson 2000). Buchli (2013), through an anthropological view of architecture, explains architecture as something other than a static space – architectural spaces sustain, shape and re-shape, social relations. So, what sociocultural knowledge leads to a greater understanding of isolation in the context of work? Most importantly, how do we connect a greater understanding of social space, or social isolation, to a practical approach for designing physical workspaces?

Physical isolation, although fluid and dynamic, is considered by NASA and HKS as something visible and measured. Astronauts are physically separated, isolated a measurable distance away from Earth. During COVID-19, architects are physically separated from their peers, working in isolation from their homes. Social isolation, as an absence of human interaction, is much more complicated. Are we ever truly socially isolated? Strathern's (2005) *merographic connections*, a way of knowledge-making that considers things as always part of something else, is particularly useful in exploring social isolation in the workplace. Stay-at-home COVID-19 workers are separated from traditional, face-to-face interactions with their co-workers. Astronauts onboard the ISS interact with their crewmembers, but they are isolated from interactions with the NASA workforce at large. These interactions, or perceptions of, are mediated through the use of technology. Mission control and Zoom meetings maintain a level of connectedness between the physically isolated workforce. According to Strathern's idea of merographic connections, this dynamic nature of separate-yet-connected occurs simultaneously. Individuals appear separated, socially isolated, from one point of view. At the same time, they are also connected from another point of view. The separate-yet-connected worker is simultaneously part and whole. Therefore, **isolation is a situated concept.**

So how do we situate this complex concept of connectedness (vs. isolation) in a physical, workplace architecture? Theoretical physicist and feminist theorist Karen Barad offers additional insight into isolation beyond a simple absence of human interaction. Barad (2007) coined the term *intra-action*, as opposed to interaction, to describe the agency of people, nature, and 'things.' *Interaction* presumes that when two entities come together they maintain a level of independence. *Intra-action*, on the other hand, suggests that entities act in co-constitutive ways – their agency is not a preexisting given. In simpler terms, actions are a result of relationships. Following this school of thought, an individual working in complete social isolation is impossible because "individuals" or entities do not have agency outside a particular intra-action. Furthermore, entities that come together to intra-act do not have to be human. The lone artist intra-acts with paint, brushes, and a canvas to produce a work of art. COVID-19 is an intra-action between human and non-human actors; the global pandemic has agency because of these intra-actions. Astronauts work onboard the ISS because of their intra-actions with their Earth-bound co-workers. An employee cannot work in complete isolation, therefore, because **actions are situated in relationships.**

So far, we have explored well-respected, yet abstract theories to breakdown the concepts of isolation and work. From Strathern (2005), we learn that isolation is a situated concept. Barad goes further to explain that work, or actions, are situated in relationships and individuals cannot act in isolation. As we look to connect social isolation with the workplace environment, Edward Hall's (1966) theory of *proxemics* provides a tangible, body-centric look

at perceptions of space and workplace needs. The four types of distances people keep (intimate, personal, social, and public) are learned through observation. Developed over fifty years ago, Hall's study of how humans use space within the context of culture is still useful in the design of built environments. Microsoft's Caitlin E McDonald (2020), a digital anthropologist, noted in a recent article that "the communicative aspects of proxemics are very important as we consider the ongoing disruptions to working and living as a result of the pandemic." Significant to the WFH worker, digital proxemics considers uses of physical and virtual spaces in connection with the uses of technology. McDonald (2020) suggests that organizations should consider replicating Hall's proxemic zones when communicating virtually. Communication, then, is a result of the WFH intra-actions of people and technology. Virtual meetings as well as the physical office produce workplace relationships. In other words, **relationships are facilitated through an environment.**

As we move closer to connecting social isolation, or the lack thereof, to the workplace environment, it is important to take a step back and consider what we observed as practitioners at NASA and HKS. In the habitat study example as well as the WFH architect survey, designers in both fields rely on scales to make sense of the work environment. The scales they use are dynamic, suggesting the ever-present possibility of change. McCabe and Briody's (2017) recent engagement of *assemblage theory* explicitly addresses the complex nature of change in organizations. Assemblage theory, first developed in the 1980s by Deleuze and Guattari (1987), provides a framework for analyzing social complexity as fluid and temporary. Assemblages are comprised of people, things, practices, discourses, organizations and institutions, and the complex nature of these components means that change is inevitable. **Relationships are situated and facilitated in an environment of constant change.**

In summary, isolation and work are actions that are situated and facilitated through relationships that exist in an environment of constant change. Viewing the workplace as an ecosystem, an emerging concept being developed from the HKS WFH studies, provides a means for grounding this complex notion in practical applications for designing the future of work.

## THE WORK ECOSYSTEM FRAMEWORK

The *work ecosystem* framework (see Figure 1) brings together Gibson's concept of *affordances* (1966) and McCabe and Briody's *assemblage theory* (2017) to capture the more holistic picture of what WFH looks like in a COVID and post-COVID world. It reflects more fully on the work experience to include place and process with underlying layers of process, time, and technology. This framework prompts a paradigm shift away from independent employer and employee context into an integrated and interdependent relationship. This interdependent nature mirrors the more intense alignment between astronauts, their environments, and their mission-critical survival. Thus, it is less about where and when we work as disparate attributes but more about how we work that ensures success. For example, Earth-bound workers have shifted from work-from-home being an ad-hoc, office alternative environment- often unavailable due to organizational policy, workflow or position (e.g., only mid or senior level staff had approval), or an employee's circumstances (e.g., lack of effective workspace, poor home internet bandwidth, etc.). The *work ecosystem* framework also taps into Hall's notion of *proxemics* (1966), with the blurring of

both physical distance and social space into scales of perception and experience; however, the *work ecosystem* acknowledges the interdependent but not necessarily nested attributes of space.

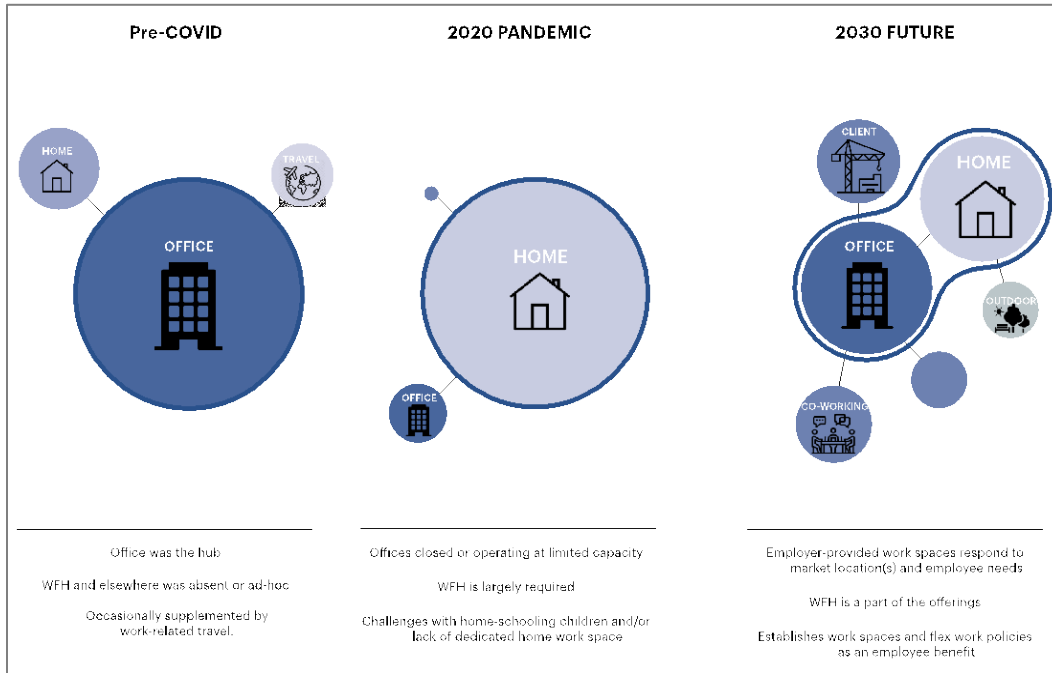


Figure 5: Work Ecosystem Framework (From HKS, pending HKS publication, used with permission)

In the current COVID climate, where home remains the primary work location, the reliance on a binary work system (e.g., home and office) serves as a distorted view of work. One life where they work and works where they live- a unique, integrated existence known well to those on the ISS. In considering the *work ecosystem* framework and the *assemblage* approach in a post-COVID time, organizations can value the role of multiple environments at varying scales for both the employee (spaces available to them) and employer (spaces offered). This has a substantial impact on organizational real estate (from consolidation/downsizing and campus planning to rethinking the need for single-tenant space and considering workspace alternatives more seriously, e.g., co-working memberships, subsidizing home office environments). Many of the astronaut-recommended adjustments appealed (and in many cases were accurate) for the initial adjustments to working from home (e.g., establish a routine, build in a mental commute, find/get a hobby). However, their real value was in offering a pragmatic crash course based on personal experiences to help with the short-term shock of WFH, especially WFH during a pandemic. They were quick fixes in an era of evolution. Six months later, while they fall short of formalizing the larger transformational changes that office work is looking for, they have provided perspective as organizations rethink and rebuild a framework for work. One with an expanded appreciation for affordances, with appropriate training and resources- giving office workers less of a do-

it-yourself survival guide and more of a foundational set of work in isolation attributes that can then inform their decision to continue (or not) in a WFH setting.

## CONCLUSION

COVID-19 has served as an unavoidable catalyst for the evolution of work- one we could have never expected. This goes beyond another iterative of the decades' long debate between topics of private or open offices, cubicles, hot desking or hoteling, standard business hours and flex work arrangements. WFH in COVID times has ushered in a fundamental paradigm shift in affordances (and acceptance) for where, when, and how work gets done. Employees and employers are now connected beyond paychecks for services rendered or physically populating real estate. They are interconnected ecosystems with elements operating at various scales. So, while astronauts were effective coaches in the initial transition to WFH, we've found that the nuances of isolation were best understood through the lens of *intentionality*. While romanticized and potentially limited in the civilian view of the role, astronauts know and accept the risks of their exploration-based employment- with its controlled projects, hyper-specific testing and retesting, simulations, and psychological support. The average office worker turned remote worker grapples with an entirely new work context with equally unexpected co-workers (e.g., spouses, children), little-to-no preparation, and every day feeling like it is all part of one big experiment with no end in sight.

The 'future of work' has been and will continue to be an ever-evolving state of being. Our reflective analysis serves as a snapshot of precedence and current context, seeking to inspire further dialogue during this transformational moment. Nuances between industries, geographies, and policies greatly impact organizations' abilities to provide for such complex considerations, however, it would be naïve to suggest that one could plan for every possible permutation. Instead, organizations need to consider their *work ecosystem* relative to that of their staff to make informed decisions for policies, processes, and place-based experiences. These reflections and recommendations leave us with several questions for the EPIC community to carry forward in the discussion and further exploration as the COVID-19 context evolves:

- How will post-COVID work experience impact commercial real estate and the continuation of offices as workplaces?
- In what ways will organizations (re)consider home office support (e.g., stipends for Internet, office supply subscriptions) as an employee amenity or even a necessary extension of the office environment for work?
- How best can organizations maintain, adapt, and embody organizational culture through digital presence?
- In what ways will WFH policies impact the recruitment and retention of talent? How might this relate to a rethinking of 'talent pools'? What could it mean for staffing?
- To what extent will the rethinking of work and workplace impact business and operating hours?



- How does an organization address technological competency in the current workforce as well as set expectations for future employees? What are the implications connected to higher education curricula?

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## NOTES

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1. This paper uses the spelling of “analog”, “analogs” common within NASA.

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