

EPIC2016

Papers 3 – Innovation

The Anthropology of Wearables: The Self, The Social, and the Autobiographical

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A wide range of new digital products lumped together under the category of 'Wearables' or 'Wearable Technology' raises fundamental questions about the way we think about our individual bodies and the species Homo Sapiens. This paper traces three different relationships to what are called the 'wearables' and extends the notion to cover all material technologies that mediate our relations between various embodied practices and the world, and beyond pure 'hi tech' products. Therefore, this paper develops a general cultural approach to wearables, informed by empirical examples from the US and China, and ends by mapping valuable design spaces for the next generation of digital technologies that are getting closer to our bodies and our skin, even venturing beneath it.

WE, THE CYBORGS

As proclaimed by Donna Haraway and other cultural theorists already in the late 1990s, the cyborgization of modern people is taking place at full speed (Haraway 1991, see also Hayles 1999). Technology is getting closer to our bodies, to our skin, and venturing beneath it. The inherent technological promise of making our lives and ourselves better, whatever “better” may mean, has led us to become reliant on novel gadgets. Consequently, we have granted technology unprecedented access to actions and relationships in our day-to-day life and even use them to reconfigure our bodily practices. One of the running claims is that the “effective traditions” of the embodied self (Mauss 2006) – culturally informed practices of the body from sitting to running, from worshipping to workshopping – are being reshaped by a set of technologies collectively dubbed as ‘Wearables’.

The wide range of new digital products, today lumped together under the category of ‘Wearables’ or ‘Wearable Technology’ (Ryan 2015) has come to question the way we think about our individual bodies and the species *Homo Sapiens*. On the one hand, the question about the value of Wearables in general links directly back to the individual body and how might they be augmenting, alternating, extending bodies’ natural capacities to act and to be affected. On the other hand, altering the capacities of an individual body within the larger context of the globalized, digitalized and uber-capitalized society is raising concerns about large scale social engineering. Thus, the questions about biopower and social governance resurface in a new context. (Lupton 2014; Ruckenstein and Pantzar 2015; cf. Foucault 1990.)

This is why Wearables touch upon ideas of what it is to be properly ‘human’ and where the boundaries of humanity lie. This is not a question that should, or for that matter ethically could, be answered only from the perspective of the ‘users’ of wearables, even if users have already started small scale revolts against wearable device manufacturers and their data

practices when they are perceived unfair (Nafus and Sherman 2014). Rather, the question about Wearables requires much more analytical reflection informed by an anthropological and cultural approach that is not reduced only to quick empirically driven user research and the optimization of user experiences. To put it in more concrete terms, Wearables (whatever individual technologies we might count into the category) pose central questions about the role of material technologies in our lives: why should we want to modify or augment whatever capacities we have as human beings today, which capacities do we want to modify, and why.

For example, when introduced, the Apple Watch promised to nudge the (assumed office worker) wearer to change positions every 30 minutes, literally promoting the change of bodily practices of its wearers. Within the Quantified Self movement, in turn, users are measuring everything from sleep patterns to quality of air, the data gathered allowing them to change their behavior in order to self-optimize. With computational power attached to many of the things we wear and embed into our bodies, we are well on our way to complete the envisioned cyborgization of the species *Homo Sapiens*.¹ The rise of the ‘wearables market’ brings this blurring of boundaries between human and technology to everyday consumers. For example, it has been recently estimated that in 2020, 411 million wearables worth 34 billion USD will be sold globally, with wrist-based devices such as smartwatches and fitness trackers dominating the market (CCS Insight 2016).

Thus, the promise attached to this category of products, (and the sheer volume of them in the market today), we believe, make Wearables a major technological driver encapsulating a techno-determinist ideology determined to change human behaviors across the globe. This is exactly why the question of Wearables - what they are, how we should think and live with them - we maintain is really a philosophical, political and ethical question about the future visions concerning the human being with augmented bodily capacities, both at individual and species levels. Thus, if we want to alter or augment the human through wearable “techniques of the body” then do we have an implicit (or explicit vision) about what is the ‘human’ that we are trying to augment, why we want this change it, and through which technological means we aim for it.

Of course, this is not only a question about the nature of the embodied human being, but also a question about how we, as anthropologists, developers, designers and consultants should define ‘wearable technology’ as a category. What is at stake here are the limits of our cultural imagination, the logic of our research strategies and analytical categories used, and their fit to the human needs we seek to identify in order to inform the development of new wearable form factors, algorithms, and overall design patterns affecting their wearers in everyday life.

Our point of departure is the claim that the current academic discourse about wearables acting as our collective cultural imagination centers around wearable technologies for self-optimization, and the ethical implications that follow. Within this discourse, some argue that the commodification of big data gathered through wearable technologies such as fitness trackers tempts not only government, but also managerial and commercial enterprises to appropriate data emerging from self-tracking for their own purposes (Lupton, 2014). Others claim that people drawn to tracking are not just internalizing predetermined frameworks but instead navigating them and ending up having more ‘agency’ than the collectors of big data (Nafus and Sherman 2014; Ruckenstein and Pantzar 2015). While ethical and political issues like these are certainly important to explore, turning them into the key aspect of wearables

runs the risk of overshadowing rather than reframing the full potential of the subject. Thus, we think that while these are important studies, they might cage the sleeping cyborg in us by needlessly limiting the sphere of cultural imagination around the body and techniques of the self.

Therefore, this paper will develop a more general cultural approach to wearables, informed by empirical examples from the US and China, and will end by mapping valuable design spaces for the next generation of digital wearables. There are three specific reasons for writing this paper.

First, and as mentioned above, most of the current studies of ‘wearable technology’ concentrate on the most popular devices today – the fitness tracker and the smartwatch. There is no doubt that the learnings from these studies are important politically, ethically, and economically. Empirically speaking this research strategy also is the only way to study the latest technologies if one defines the category of ‘wearable technology’ in the way the consumer electronics industry does today. We feel, however, that the discussion needs to be steered towards more profound questions related to the category, such as how to define ‘wearable technology’, or if a reconsideration of what ‘wearable technology’ consists of is needed. We claim that we should do so to arrive at culturally informed, anthropologically sensible analysis of our anthropological present that is valuable to the developers of future wearable technologies.

Secondly, we think that this line of questioning allows us to avoid the premature closure of discussion and to remind us that the results from user study results concerning the most popular new wearable devices of today – trackers being the prime example– might not be generalizable over time as the technologies affecting our embodied being are themselves changing rapidly. Consider, for example, the latest much hyped developments around exoskeletons, augmented contact lenses, interactive skin and tattoos that are very different from trackers, and their effect on human lives are still largely unknown. We claim that opening up the category of wearables this way can lead to more open research settings in terms of the technology studied, and therefore also to more profound and long lasting insights in comparison to one that takes the current market definition (wearables as trackers) as an unquestioned starting point for the study.

Thirdly, precisely because of the two reasons cited above, we think that ‘Wearables’ should not be *primarily* defined through their form factors (technological objects one can ‘wear’) or their technical functions such as ‘tracking’ (or nudging, reminding et cetera). Instead, the question of *wearable technology* should be re-articulated in terms of the relationship they have to our bodies, social selves, and our personal identities to arrive at more useful insights about the role of these technologies in our lives.

In this paper, we will first take a look at how technologies placed close to our bodies can assume culturally relevant roles and help to mediate key relations central to our embodied being. We start this section by quickly reminding the reader that the question about human bodies and their alteration with technologies that one can wear is not culturally new. Instead, it is a question that runs deep into the essential thought processes of the Western civilization. Next, we will demonstrate how and why these relationships become important when thinking about wearables in the everyday life with empirical illustrations from the US and in China. Here, we turn away from the newest of wearables to study more ‘traditional’ wearable technologies as we argued that these will teach us important lessons about what can wearables do to their wearers, and what is expected from them. Finally, we conclude by

suggesting broad design domains for the three possible relationships wearables mediate, and discuss how these might benefit the innovation of more relevant wearable technologies in the future.

THE WEARABLES MOVEMENT RE-CONTEXTUALIZED

The ‘wearables movement’ as we witness it today started out second half of the 20th century as a science fiction dream about enhanced humanity, like so many other technological breakthroughs (Ryan 2015). The idea here was to augment human senses and capacities to act in the world, something which was driven by two world wars and the discourse of eugenics (Ryan 2015). Superheroes in popular culture paved the way for the vision of clothes and objects enabling powerfully enhanced personal abilities such as increased strength and speed (Ryan 2015). And although multiple decades have passed since the beginning of the movement, Joanna Peña-Bickley, the Global Chief Creative Officer at IBM iX, points out that science fiction remains the primary reference discourse when thinking about the category:

...when we think about wearables, and what I do with wearables, is a sense of understanding that when it comes to designing wearables, it’s just not a technology... We as designers actually have to use a little bit of inspiration from our everyday lives. For me, that inspiration comes from reading fiction, and science fiction. And understanding that the potential of wearables is actually to elevate human experience.
(Joanna Peña-Bickley, 2015)

This movement has been powerful in defining many of the discussions today about what a ‘wearable’ is – a category of new products that are digital, interconnected to our body. At the same time, against this background, we should also start to question the whole category of wearables, and inherently linked to this, the idea of the whole embodied experience of the anthropos. Science fiction itself has deep philosophical undercurrents, with unexpected connections between philosophy, technology, art, and religious meditations as Eugene Thacker (2011) has recently argued with his ‘Horror philosophy’. Similarly, while recognizing this approach is not equivalent to ethnographic research, we kick-off our paper with a brief exercise in cultural semiotics.

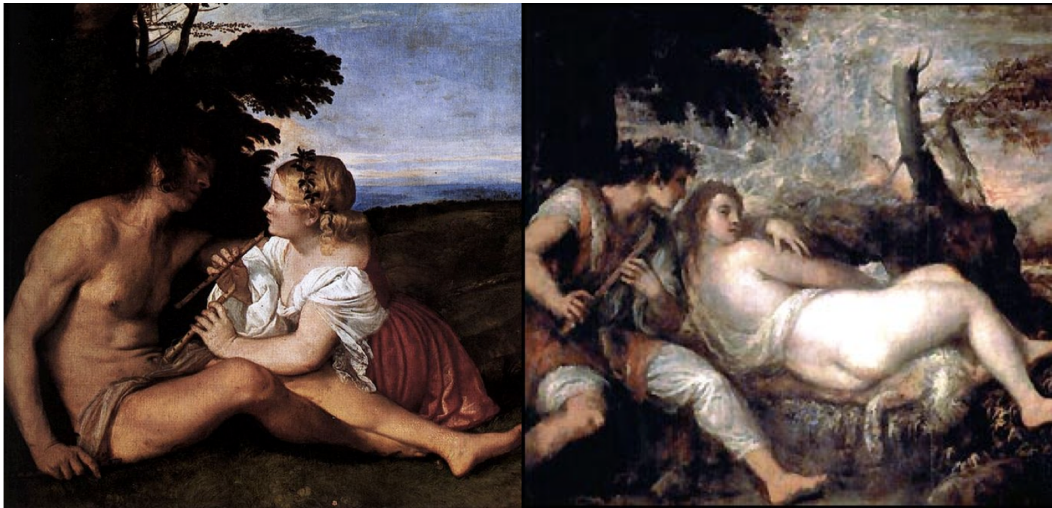


Figure 1. Titian's "The Three Ages of Man" (1514, left) and "The Nymph and the Shepherd" (1576, right)

Titian (a 16th century Italian painter) is particularly important as a window into earlier Western thinking on man's relation to wearables. His two paintings "The Three Ages of Man" (1514) and "The Nymph and the Shepherd" (1576) mediate the nature of man across a 60 years distance.

"The Three Ages of Man" shows a nymph waking man up to his nudity and physical desire, or to a new understanding of his body. The nymph is fully dressed and holds two flutes in her hands, her light touch on man's naked body urging him to rework what it means to be human. In the second painting, "The Nymph and the Shepherd", the same characters are revisited. In this depiction, the tables have turned and it is now the man that's trying to lure the Nymph. He is now the one fully clothed and in charge of the flute, trying to seduce the now-naked Nymph and her spirit, beauty and power that go beyond the bodily presence. Behind them, the tree of knowledge is broken and withered, its decay indicating that man has used it to learn something divine. One way to interpret these two paintings is that in the time gap separating them, Titian came to a threefold conclusion about man. These three different interpretations of what it means to be human not only indicates man's relationship with other beings, but also his relation to the wearables and objects around him.

In "The Three Ages of Man", man is one with a body and bodily practices that the nymph is attempting to lure into her power. He is naked; his abilities limited to the scope his own body. With her mythological power, the nymph is trying to lure him beyond his current capacities, reappropriating his body to her wishes. Man, then, is a body waiting to be seized and enhanced by using external attributes, and according to the will of something outside of himself.

In "The Nymph and the Shepherd", man is instead understood as a being that yearns for beauty, love and imagination. He is the one wearing garments and using objects to exert power over the naked body, the nymph. In this representation of man, man is not waiting to be appropriated but instead has a more agential relationship with the world and its objects. In the years between these two paintings, Man has become what he is - a creature longing for belonging to an imaginary community of beauty, represented by the Nymph. He has

become what he is through a particular biographical development, now marked by the singularized clothing he wears as the symbol of an individual.

The final meditation on the 'nature' of man and his relationships to objects and beings emerges in the role of the clothing and flute. They are wearable (and playable) technologies of mediation building a bridge between the previously unexplained representations of man. The practice of wearing garments bridges the gap between the docile body and the agential man, between the physical world of the flesh and the imaginary world of love, beauty and desire. Through these three interpretations it becomes clear that wearable technology, such as clothing veiling the physical body and summoning the Nymph, mediate our experience of the world and other beings in it. This makes 'wearables' into something essential to human experience, and a category of technologies that is at once enigmatic yet totally defined by the relations it enables toward the self as a body, the social life involving imaginary belonging, and the autobiographical growth as an individual.

The term wearables is today often presented as a new category and taken to mean digital devices such as a wristband, clip-on activity tracker, or a heart monitoring shirt. However, as argued by Titian already in 16th century, albeit the digital aspect of wearables is fairly recent, the category itself is not. Historically, as represented by Titian's painting, even very 'basic wearable technologies' such as clothing have always been bound up with the art of *technique* - ideas, behaviours, and materials come together on our bodies so as to administer to our human condition. As Ryan (2015, Dress and Technology) explains,

“[h]istorically, from providing warmth and advantages in battle to facilitating sexual reproduction and social selection, technologies have adapted to the body to allow us to become (or imagine becoming) more agile and powerful, more sexual and desirable (e.g., the attention to sleekness was aided by the development of synthetic fibers in the early twentieth century), or more or less noticeable”.

The essence of wearables does not lie in its digital characteristics, but rather in the relationships with the world enabled through their usage. And while the current discourse seems to argue that the digital characteristics of the so called new wearable technology crafts relationships with the world that are, in essence, new, we argue that as these relationships are fundamental to the embodied experience they are less likely to change radically with the 'newest new' wearables. Thus, wearables, as discussed today, are not best defined as a new category in itself, but rather a refashioning of old categories of material technologies (like clothing, accessories and jewelry, and also sports and medical devices) that have their own historical cultural norms, occasion-specific rules and appropriation patterns, now becoming infused with digital capabilities.

EXPLORING THE THREE CULTURAL SPACES FOR WEARABLES

The previous section has explored three ideal ways for humans to be and relate to the world through wearables. These were the 1) relation to the self as an embodied being, 2) social relations of belonging (to real and imaginary communities), and 3) the autobiographical relations wearables mediate. It is important to note that every wearable and object holds the promise and potential of these three relationships. As shown, it is not the wearable per se that is the deciding factor, but rather the motivation behind the usage of it. This opens up

for the possibility of fluidity of the relationship; a wearable can fit into multiple categories at once. This section aims at illustrating and further exploring these relationships through a theoretical discussion, as well as empirical examples gathered throughout three projects in China and the US between 2013 and 2016. These projects have been studying the most traditional wearable technology categories: clothes and luxury accessories. As previously argued, this kind of cross-project fieldwork data is suitable for the purpose of exploring wearable technology, as the category of wearables should not be defined through the form factor or function of the technology, but rather through the different relationships technologies have on the body, the desired social community and the sense of self as an autobiographical being.

Wearables as Technologies of Discipline and Control

Interestingly enough, currently only one of the three relationships outlined above is mirrored in the popular wearable technology of today and in the industry vision for the future (PSFK 2014). This centers around wearables as technologies of discipline and control, following the trajectory around self-enhancement that the first sci-fi enthusiasts set in motion.

Here, ‘optimization’ of the self, based on meticulous calculation of the data generated by wearables tracking different aspects of the self and translating this into numbers, allows for a new kind of experimentation on one’s own body (such as the Quantified Self movement or biohacking). This encapsulates the ideological underpinnings behind the popular wearables such as Fitbit (see Ruckenstein and Pantzar 2015).

Consider, for example, the following example. In 2016, Mike, a 50 year old man living in NYC, during an interview by the first author, commented on the Apple Watch on his wrist. He was lamenting over the fact that one of the key functions of the watch did not work: “I wish it did something to me, would get me to train more. But it’s mostly good for checking out time and silencing incoming calls”. To Mike, the Apple Watch was constructed as a commitment to an augmentation of the body, yet it failed to instill the bodily discipline he was lacking even if he was open to the idea inscribed in the watch.

The lack of change in lifestyle that Apple Watch promises, similar to the findings from other studies (see e.g. Pizza et al 2016), is to us, not the most important point of his comment. Instead, the comment reveals something important about the relationship between the wearable device and the wearer, namely that idea of optimization of the flesh effectuated from outside is about technological mediation of the fragile link between morality and the body. As proved by Titian’s first painting, this way of relating to our surroundings is not new. Indeed, throughout history, the technologies of dress have adapted to the body to enable enhanced, or at least perceived enhanced, personal attributes (Ryan 2015). The self put forward in this interpretation casts wearables as a predetermined framework that appropriates the individual’s body in order to enhance it. Sensors and self-tracking options enable the individual to measure almost any aspect of his or her daily life. This new form of body is shaped by the ideal of keeping fit as proof of mental discipline and the capability to perform in challenging knowledge economy jobs. The augmentation of human capabilities is highly supported by functional tracking wearables and will no doubt be successful and transform what we think about our bodies and our humanness in terms of corporeal possibilities; in essence changing our understanding of physical labour, wellbeing

and health and tasks requiring extra senses. However, clearly, in this case, the Apple Watch did not live up to this promise, to the great disappointment of Mike.

An example of a slightly different type of optimization relation mediated by wearable technology is provided by Sam, 30, a practicing American Sikh living in Los Angeles. For him, wearables not so much represented the idea of bodily self-enhancement. Instead, he showed us the silvery Kara bracelet worn around his wrist. The Kara bracelet represented a specific type of wearable used within Sikhism as a consciousness activation tool. Sam told us that “it keeps me handcuffed to God, keeps me on the right path, it’s part of me always”.

The idea behind the Kara bracelet is to morally steer the wearer and to guide them through life in accordance with the religious beliefs promoted by Sikhism. For Sam, bracelet thus operated as an ever-present tool for moral guidance and direction, making its users adhere to a predetermined framework set by Sikhism as a religion. Again, this non-digital wearable bracelet was mediating a moral relationship between his embodied self and its weak flesh and God’s superior will, imposed from the outside and mediated through the Kara he wore on his wrist.

Finally, throughout our different projects in China and the US, people often return to the issue of dressing as technologies of control as the standards for certain occasions are set by someone else. Consider how in 2013, Dione, a 31-year old public health worker living in San Francisco, described that she is only starting to understand how the dress game is played in professional context:

I was always really good at my job, but I wouldn’t advance and I wouldn’t know why. I think it took all of my 20s really to realize that impression management is a thing, and people judge you on how you look at work. I think my style is kind of funky outside of work, I try to tone it down at work.

She loves color but she wears more muted tones to work. She only wears natural toned nail polish and stays away from cold colors, usually gravitating towards warmer ones. She says that in order to get a sense of what to wear, she looks at what her colleagues wear.. However, she has lately adopted the saying “Dress for the job you want, not that job you have”, and so even if she is at a lower level, she makes sure to exude professionalism and look like she could be higher up. For her, clothing thus becomes the wearable technology for augmenting her appearance to adhere to a predetermined normative framework. A similar story was shared by Chao, a 29-year old woman working in the clubbing industry in Beijing:

The clubbing industry is really dominated by men, when they see me they often think that I’m just one of those party girls that ended up working in this field because I was some DJ’s groupie. So I try harder to portray myself differently... I wear smarter clothes with them, I act with more determination... to show that I have that business sense and I know what I’m doing.

Chao uses wearables to prove both what she is and what she is not, using it as a disciplinary marker to differentiate herself and measure up to the standards of a particularly male-dominated field of work where femininity is constructed as being in opposition with business sense and hard knowledge. In these examples from China and the US, clothes are not worn only to augment their bodily appearance to fit into expectations set by their various

fields of work, but also to measure up to standards of femininity required to be regarded as attractive and fitting for romantic interests. However, the romantic ideal is in stark opposition to the standards of professional work. Where wearables in work culture is used to enhance stereotypically male attributes, the romantic ideal plays on ultimate femininity.

Through these illustrative examples we can see how wearables work as *technologies of the self* (Foucault 1988), enabling individuals to transform themselves in order to (try to) attain perfect self-optimization. In this respect, wearables become an instrument for the individual to perform ethical work on him- or herself through “monitor[ing], test[ing], improv[ing] and transform[ing]” the own body (Foucault 1986:28). It also becomes apparent that within the category of wearables acting as objects of discipline and control, there are three types of (sub)disciplinary domains. The first is about wearables as objects of bodily discipline; increasing for instance strength and endurance through various tracking devices that allow (or not) for the creation of a new link between the body and the optimization ideology. This is the domain where the wearable technology of today currently positions itself. The second domain represents wearables as objects of moral discipline, enabling certain actions due to a set frame of for instance religious beliefs, and preventing others due to the same reasons. The third disciplinary domain tackles the issue of wearables as objects of social discipline, which is where what has traditionally been seen as wearables have a strong presence in enhancing the certain features of the wearer’s self that are constructed as desirable in a specific situation. These three domains all articulate a relationship between the wearable and the wearer as a dominating one. Here the wearable technology mediates existing cultural ideologies and exerts cultural power over the wearer’s body and mind from the ‘outside’ – much like the Nymph in Titian’s first painting.

As previously argued, while some types of wearable technology clearly provides a new context for discussing issues of biopolitics, to truly understand the interrelationship between wearables and the human way of existing in the world requires to us look at the category from a broader scope. Hence, we will now reflect upon wearables from other perspectives put forward in Titian’s paintings to further explore the category and its potential for innovation.

Wearables Mediating Love, Imagination and Belonging

Compared to Titian’s two paintings, wearables make out a tension between Titian’s first depiction of man as being appropriated by wearables and the second idea of man in control of his own destiny. This more mature, grown-up man is taking part in a symbolic system where, even though it’s an interplay of production and reproduction, the individual has power over the wearables and uses them in the re-creation of the self in a *pursuit of belonging*. One way to operate within the logic of this new form of mind is through curated, cultured consumption such as fashion. While fashion in an urban context might seem to be about clothing and accessories, however, as proven, the physical attributes are not the primary point. Instead, fashion is about the imaginary sense of belonging, combining different attributes to enable and execute self-expression as a member of a desired social group. It is a habitual layering on the body, an agent-structure negotiation of social identity and class (Bourdieu 1977).

One could argue that the self-optimizing wearables of today are already forming communities. Many self-trackers view themselves as part of a bigger community in what

Lupton (2014) calls ‘communal self-tracking’, thus generating a new form of biosociality through communities emerging around new biological identities (Rabinow 1992). However, the primary goal remains to acquire personal benefits rather than being part of a collective (Lupton 2014). In comparison, the pursuit of belonging in Titian’s second painting refers back to the individual movement ‘outwards’ from him- or herself toward a collective rather than the shaping of the body through external ideologies or forces beyond his or her control.

According to Baudrillard (1981), consumer objects have no meaning in themselves, rather, they acquire meaning from either their social order, their relation to either people or other objects. Wearables are part of a symbolic value system and adhere to the logic of *bricolage*. This means that despite the nature of the symbolic community (e.g. sports or medicine) and the type of wearable supporting it, people fashion technologies to their own life and own needs, and to their own ideas about the self they want to express (Kaplan, M. 2015). This is done through combining and recombining a limited set of wearables, depending on various reasons such as personal values and economy, to come up with new ideas and ways for self-expression and self-differentiation. In this way, wearables become entrance points to what Benedict Anderson (1983) calls ‘imaginary communities’, communities created by mental imagery of affinity. Wearables thus become part of a system of other wearables on the body of the wearer, but also a symbolic system to which it grants access.

This type of relationship between the wearable and the wearer is exemplified by Yao, a 32-year old HR manager living in Beijing, who proudly showed the first author a padded jacket in bright colours when touring her house. Upon showcasing the jacket, she explained: “This is my tailor made jacket, I wear it when I go on these bike rides with my friend. He has a Harley-Davidson”.

Ying uses her jacket for self-expressive reasons, becoming a part of a symbolic community with certain values and preferences. In this context, the jacket marks a social belonging to a Chinese rendering of a Harley-Davidson lifestyle. Ying has chosen this community herself, giving her the agency of choice and power to influence the community she is entering through the wearable.

Another example further illuminates the inherent symbolic potential in all wearables. Chao, the woman who used particular kind of look to gain respect in the clubbing industry, also repeatedly emphasized how different she is compared to the average Chinese woman of her age, and how she signals it when she wants to: “I think I just wanted everyone to know that I was different, so I was even purposely acting crazy, just being completely crazy – who else would wear these kind of necklaces. No one!”

This notion of wanting to stand out was also reflected in her choices of necklaces and other accessories; she had a preference for vintage ones since they signaled her uniqueness. Through the vintage wearables, Chao is able to symbolically display her lifestyle and personality. Interestingly enough, although vintage wearables could certainly guarantee entrance into an imaginary community, it is a community that, for Chao, centers around standing out from the crowd, not being a part of it. Thus, vintage wearables, in this case, grants access to a community that works on the logic of expressive dissimilarity rather than likeness.

As proven, wearables, like all other objects, already have the inherent promise of opening up to social systems and imaginary communities. Hence, we argue that instead of adhering only to the goal of self-optimization and tracking, there is great potential for

wearables to explore this culturally relevant space, where a number of ‘old wearable technologies’ already mark its boundaries (e.g. fashion garments). The space of belonging and imaginary communities present a largely untapped potential for ‘wearable technology’, even though some companies have tried their wings here (e.g. Intels’ MICA bracelet) and failed.

However, it is crucial to note that when playing in the predefined symbolic field where fashion has long been in the game, the design of wearable technologies - or any other technologies for that matter - needs to adhere to the same symbolic logic. In order to do so, there are a number of obstacles to overcome for wearable technology, such as creating easy customization of hardware (Kaplan, K. 2014, 2015). Although the smart textiles market is expected to grow at a CAGR of more than 30% in 2021, the growth will be restrained by the high cost of production (Research and Markets, 2016), and needs solve the problem of how to make technology stretchy and flexible on the wearer’s body (Kaplan, M. 2015).

While wearable technology provides plenty of functional value in terms of self-optimization, it fails to adhere to the norms of fashionable dress as they support an instrumental view of the individual rather than playing around with the fashion norm of changing every season (Ryan, 2015). When failing to accommodate to the logic of fashion wearables become an obstacle in the system. This forces people to rethink all the choices that go into composing a look, in contrast to how smoothly the system runs when everything is operating according to its logic. In order for wearable technology to be able to truly work within the system of people’s everyday lives, it needs to resolve these obstacles, and acknowledge their potential to work as entrance points into symbolic systems of value. Thus, the design philosophy cannot solely rely on perfecting functionalities – such as heart rate or movement tracking – the way most popular wearables now do, but needs to offer clear symbolic value beyond functionality (whatever that might be). However, it is crucial to note that adding symbolic meaning does not lessen the importance of the technology; neither one can be lacking in order for the wearable to succeed. Note that this does not mean that every technology brand is believable as a creator of fashion. While there are examples of functional wearables stretching into the domains of fashion (the perfect example being the athleisure trend), there is usually a need for a strong social and symbolic capital to transcend the functional connotations of technology in making it socially aspirational. To take a more holistic approach to innovation, designers of wearable technology need take the symbolic world they want to be a part of as a starting point, rather than taking inspiration from the functional (or technological) cues that the category currently presents.

Wearables as Autobiographical Objects

The third relationship which we urge the category of wearables to explore is, from an anthropological perspective, the most fundamental one. Here objects work as containers for personal value and affection. This makes the objects stand the test of time, increasing in value as it progresses. Wearables that are autobiographical surround ourselves as they become companions to our emotional lives and provoke thought over extended periods of time. These two familiar ideas are brought together in the notion of singularized technological objects (Kopytoff 1986, or ‘evocative objects’ as Sherry Turkle 2007, calls them). These objects embody thoughts, memories and feeling for a relationship they stand

for as technological tokens. Seen in this light, some wearables come to represent and embody love towards a singular person or object, a technology of relationship, continuity and emotion; the wearables become an object to manifest a coherence of the self. This personal valuation also makes these objects escape the objective commodity pathway. Autobiographical wearable objects primarily gain their power from the specific situations and given circumstances enabling them to enter into the life of their owner and to stay in possession. This can be exemplified through old objects and heirlooms which are already singular, evoking memories and particular emotions. However, new objects can also become evocative or personal, through singularization processes and their relationship with the user or owner. This then marks a shift in value from economical to affectional, and a withdrawal from the market (Appadurai 1986; Kopytoff 1986). While heirlooms and antiquities might be the first artefacts that spring to mind when thinking about autobiographical objects, brand such as Patek Philippe, the Swiss luxury watch maker, proves that it is possible to manufacture wearables with perceived almost inherently timeless qualities. This is of course supported by both actual long-lasting functionality and branding, the slogan being that “You never actually own a Patek Philippe, you merely look after it for the next generation” (Patek Philippe 2016).

In Turkle’s (2007) notion of evocative objects, they are explained as symbolically taking the owner with them on a journey. For Yao, a 35-year old living in Beijing, one item in her closet was used to literally accompany her on journeys. As the first author toured her home for a fashion objects in 2013, she opened her closet, taking out a straw hat with a black-and-white ribbon. She exclaimed: “I love this hat! I wear it on holidays and it makes me feel happy and free”. When buying the hat, it had probably just been one of many, attracting Yao through either its functional or aesthetic features. However, through using it year after year, and always on her holidays, it becomes inscribed with personal meanings of happiness and freedom. Even when on its shelf in the closet, it works as a point of reference, a straw clad reminder of carelessness and *joie de vivre*. Thus, this hat becomes a wearable technology that links her back to her prestigious happy memories over the years. The hat, for her, is an autobiographical wearable, a container of the key moments in her personal history – this hat is a wearable technology of memory and feeling that mediates between her present self and all the happy selves of the past.

Current digital technologies have fast replacement cycles because of rapid development of processors, sensors and battery technology. This leads to technology becoming obsolete within a few years. Wearable technology thus becomes devalued with regards to two aspects of singularisation. Firstly, compared to timeless pieces such as classic watches or jewelry, current wearable technology has a short life span – too short to become autobiographical. As the lifespan of current wearable technology (trackers, watches) is comparatively brief, this type of wearables never has the chance of becoming evocative objects. Secondly, current wearables remain commodities they lack the power of being made singular and withdraw from the market, especially regarding the value judgements and comparison to other objects currently in the market place. Moreover, in a networked society it is also hard to inscribe personal meanings and affections in objects that are always on and connected to other devices – the ‘individuation’ of the device proves extremely difficult.

The rapid temporal cycles of current technology have profound environmental impact, giving rise to the term *techno trash*; “the environmental brutality of planned technological obsolescence and conspicuous technological consumption” (Hogan and Zeffiro 2015). From

this perspective, all technology is designed to be trash(ed), leaving a major trauma upon the earth (Hogan and Zeffiro 2015). Indeed, the notion of the Antropocene implies that we are, for the first time in history, living in an epoch when human activity is significantly impacting earth's geology and ecosystems. Haraway (2015) emphasizes that this impact is created first and foremost by capitalization of resources rather than by humans in and of themselves, and proposes that the Capitalocene might be a more fitting name. Although one could certainly argue for it being a consequence of human life, Haraway (2015) sees capital as the major driver in the current epoch, which forces researchers to rethink the starting point of the period.

The notion of wearables as autobiographical objects is thus profoundly linked to sustainability and a continual relationship with the same technology over an extended period of time. When designers and engineers can overcome the previously mentioned technological obstacles, we strongly believe that there is an untapped potential for wearables to be further explored through this notion. The issue of how to embed a sense of familiarity in technology has already been somewhat explored in the notion of 'calm technology' (Weiser 1995), where one of the three prerequisites is similar to that of Turkle's (2007) evocative objects. This feature centers around technology transmitting a sense of familiarity to the user, allowing an awareness and sense of continuity with the of past, present and future surroundings. The sense of familiarity and comfort is further investigated through wearables such as Tjacket, a wearable technology vest that provides its wearers with customizable deep touch pressure that calms down sensory seeking and/or sensory over-responsive people (Tjacket, n.d.).

Wearable technology as autobiographical objects is a sustainable design space that is opening up new meanings and potentials of how the category can evolve to enable people to better understand and situate themselves in the world. We hope to see a near future where wearable technology is able to take a cue from Patek Philippe (2016), urging its users to let the wearable enable the wearer to "begin [their] own tradition" and once again let 'the next generation' be framed within the trajectory of the family and interpersonal relationships, rather than the newest update in a product line (Hogan and Zeffiro 2015).

SUMMARY: RETHINKING WEARABLES THROUGH THREE KEY RELATIONSHIPS

We have argued that anthropologically informed, ethnographic inquiries into 'Wearables' enables us to build cultural taxonomies that are relevant in thinking new ways to innovate within the category. More generally speaking, new perspectives and cultural taxonomies formed through ethnographic research are valuable as tools for innovation, as they help to reframe key questions of the category in new ways – in people's terms. As such, they challenge normal innovation practices focusing on technological functions and forms by redefining the design targets around what people find relevant and valuable in contrast to innovating around products and features. These new culturally relevant design targets, exemplified here by our three spaces for wearables, are valuable for:

- *identifying* future product directions,
- for *diagnosing* high dropout rates for wearables by examining behavior around adoption,
- or for testing product functions in context and setting culturally relevant testing criteria,
- and, last but not least, for doing product planning, roadmapping and cultural portfolio optimization based on these taxonomies.

Thus, we have argued that the category of wearables should not be defined through its form or technical function to truly innovate within the category. Instead, the essence of wearables stems from the relationships mediated between wearer and the world, and between the current and past selves. We claimed that wearables take on three relations in relation the embodied self: as technologies of discipline and control (bodily, moral and social), as technologies marking social belonging and desire, or as technologies of autobiographical importance. Articulating the question of ‘wearables’ through these domains helps to see that wearable technologies have already today much broader roles than previously defined, creating a taxonomy of relevant cultural spaces that can be turned into new innovative design domains and briefs (see table 1, table 2 and table 3). This is a way to turn anthropological insight gained through ethnographic research into a tool for category innovation, and to set the direction for future design spaces. These new design spaces are not only great sources to front-end innovation teams as they describe valuable cultural practices but also work as more structured design briefs for R&D and product planning teams who seek new tools to go beyond product function or technology led innovation agenda setting.

Table 1. Wearables as technologies of Discipline and Control
Summary of mediated relationship and design implications for innovation

Typical functions	Bodily discipline: tracking, reminding Moral discipline: Social discipline:
Symbolic jobs-to-be-done	Becoming the fullest you, fitting in and feeling "worthy", being an able individual in the specific context
Overarching design drivers	Optimizing the wearer through augmentation and/or nudging
Traditional wearables examples	Sportswear, shapewear, posture wear, Kara bracelet, shapewear, work uniforms
Wearable technology examples	Trackers, Google X Labs smart contacts, HoloLens, Chromat Aero Sports Bra
Temporal cycle	Industry: Cycle lasts until the function of the wearable is no-longer working or up-to-date Learning curve: most people stop when they have accessed enough knowledge about the topic the wearable is being used to
Design implications for potential technological aspect of the wearable (functional requirement + possible use cases)	<p>Functional implications:</p> <ul style="list-style-type: none"> Technology that is focused on optimizing function: nudge and/or augment the wearer <i>Consider how trackers help the wearer to get functional benefits such as increased health and/or efficiency</i> Ability to track to help in optimization and behavior change <i>Consider how the Apple Watch nudges wearers to change (work) positions during the day</i> Moral steering of physical and mental actions <i>Consider how the Kara bracelet morally enables and prevents certain actions among its wearers</i> <p>Material implications:</p> <ul style="list-style-type: none"> - <p>User interface implications:</p> <ul style="list-style-type: none"> Amplification of physical capacities and mental performance: Filtering of impressions to enable wearers to get the most out of the task at hand <i>Consider how the Altruis smart ring lets wearers customize which alerts and notifications should come through</i> Second-order learning: acquiring knowledge around the rules of learning and change <p>Connectivity implications:</p> <ul style="list-style-type: none"> Depending on context -

Table 2. Wearables mediating Love, Imagination and Belonging
Summary of mediated relationship and design implications for innovation

Typical functions	Self-expression, marking of social community, escapism, developing the social and cultural capital
Symbolic jobs-to-be-done	Plays on freedom, imaginaries, love, desire and beauty
Overarching design drivers	Fitting into the ecosystem of lifestyle objects, easy to do bricolage
Traditional wearables examples	Statement wearables recognizable to the ones who need to know, for instance fashion brands
Wearable technology examples	Intel's iQ fashion forays, Google's project Ara
Temporal cycle	Various shorter cycles (cf. fast fashion, seasonal fashion, classics)
Design implications for potential technological aspect of the wearable (functional requirement + possible use cases)	<p>Functional implications:</p> <ul style="list-style-type: none"> Main-function remains while smart add-ons can be changed <i>Consider how the Montblanc e-Strap, a changeable watch strap with a smart display, lets wearers keep the strap up-to-date through changing it, while still being able to form a lasting relationship with the retained analogue clock</i> <p>Material implications:</p> <ul style="list-style-type: none"> Technology that is able to stretch and follow the forms of the body <i>Consider the touch, feel and shape of textiles and fabrics and their ability to flow on the wearer's body</i> Discreet technology that lets the symbolic value of the wearer stand at the forefront <i>Consider how the Fossil Q Non-Display Smart Watches look like analogue watches but has activity and notification trackers and built into it</i> Customizable and changeable hardware and accessories <i>Consider the Moto 360 Maker that lets wearers choose between watch straps and displays in different colours and materials</i> <p>User interface implications:</p> <ul style="list-style-type: none"> <p>Connectivity implications:</p> <ul style="list-style-type: none"> Possibility to symbolically connect with a shared community <i>Consider how communities are formed around certain brands</i>

Table 3. Wearables as Autobiographical Objects
Summary of mediated relationship and design implications for innovation

Typical functions	Infusing the owner with feelings of familiarity, continuity of identity, sense of true self, reflection
Symbolic jobs-to-be-done	Marks familiarity, affectionate value, connected to remembering and reliving
Overarching design drivers	Long-lasting, getting more valuable over time, rooting the wearer in temporally developing relationship, emphasizing the sense of wearer's cosmological location
Traditional wearables examples	Wedding rings, heirlooms, tattoos, watches, expensive jewelry
Wearable technology examples	Failed examples: - The Autographer camera - Teledildonics
Temporal cycle	Life-stage cycles (cf. marriage cycles)
Design implications for potential technological aspect of the wearable (functional requirement + possible use cases)	<p>Functional implications:</p> <ul style="list-style-type: none"> • Low-powered <i>Main function should be able to be used over a long period of time</i> • Core features accessible in offline mode <i>If/when the technology loses connection, breaks and/or becomes obsolete, the object should still be useable</i> • Ability to store, hide and display personally meaningful data <i>Consider traditional necklace charms with space for family pictures (US) or locks of hair (China)</i> Sleeping technology that activates only in meaningful instances <i>Marking the different life-stages: weddings, child birth, retirement and so on</i> <p>Material implications:</p> <ul style="list-style-type: none"> • Long-lasting technology with the ability to age beautifully <i>Consider how the surface of a copper plate changes over time to reveal its age, or how trees get growth rings over time</i> <p>User interface implications:</p> <ul style="list-style-type: none"> • Technology that invokes a sense of familiarity among the user <i>For instance, through an intuitive interface.</i> <p>Connectivity implications:</p> <ul style="list-style-type: none"> • Ability to turn off connectivity to other devices <i>Preventing the interconnectedness with other objects in order to stimulate individuation</i>

Traversing these three categories, there is a fourth possible relationship to be carved out: that of humans relating to the surrounding world through magic. Amongst others, this implies consecration and sanctity of objects and places, interaction with supernatural powers mediated by an expert and employment of symbolism and purification in rites, as well as

importance of tradition and continuation of knowledge with the ultimate goal of reaching tangible results (Mauss 1972). Technological advancements within contemporary clothing is sometimes linked to the idea of security and protection of the wearer (examples are Chromat's Adrenaline Dress, Ezra+Tuba's Butterfly Dress or Nimb's smart safety ring). Furthermore, the wearables category offers multiple authentication tools (for example Nymi, a wristband that authenticates individuals through various biometric modalities such as heart rhythm). These examples border on attributing characteristics of guarding objects to wearables, to some extent similar to the magical ward of for instance an amulet. However, technological wearables currently present purely functional safety, rather than the symbolic safety provided by magical objects that run counter to the idea of functionality. Indeed, while they are both goal-focused, technology reaches its goals through experimentation and development rather than belief (Mauss 1972). Furthermore, magical objects create consequences which are hard to foresee and explain, linking the individual to a higher presence (Mauss 1972). It is questionable whether wearables can provide or engineer the randomization inherent in magical objects, however, wearables incorporating augmented and/or virtual reality to some extent holds the promise of making magic visible and manifest.

Furthermore, magical objects create chains of mediations and effects which are hard to foresee and explain, by linking the individual to higher forces that are not fully controllable. This is increasingly reflected in the idea of 'cloud computing' with the metaphors that link it to religious and magical imagery, such as to the all-seeing *eye* and god-like forces sitting on top of a *cloud*. On the one hand, only a select people – the modern clergy – can truly access and understand the language of the cloud, or the data gathered from the wearable devices. Even fewer can bend its will. On the other hand, an increasingly large legion of 'users' is bound together by these forces through wearables connected to a 'cloud' and the data they track and transmit, bringing together new social groups across geographical and temporal distances. Magical cloud-based wearables already connect the 'users' to a re-enchanting, worldly infrastructures that are fully controlled by (ideologically, economically, religiously motivated) third-parties. This will reshape what we can know, access and change about ourselves and others around us (called the 'Stack', or the 'Black Stack', see Bratton 2015). Thus, the task for anthropologists of our age is also to critically examine, and constructively reframe these infrastructures that wearables are increasingly part of.

In order for the category of wearable technology to truly innovate, it is crucial not to lose sight of the overall understanding of what wearables and objects enable people to experience beyond innovated technical functionalities. When viewed critically, there is nothing new about 'wearables' in themselves – they have been around as long as *Homo Sapiens* has (furs, sandals, rings, amulets...). This is why innovating on a product and function level the category will lack strategic insight in how to refashion itself to better understand and adapt to the needs and motivations of consumers.

It is only by taking a step back and applying a culturally informed view on wearable technology that we can innovate and develop products that cater to the aspirations of people. This is, we think, what it means to use anthropological thought and sensitivity to reimagine the whole category, and how cultural taxonomies such as the one presented in this paper work as a new tool for innovation. Furthermore, with feet firmly rooted in the discipline's anthropocentric concerns, the ethical aspects of wearables touching both anthropologists and engineers should steer us to design long-lasting, sustainable solutions that

respond to human needs and enhance our social relationships in contrast to throw-away wearables aging fast. This means that as a community of ethnographers deeply entrenched in the corporate world, we should aim for sustainable and ethically sound solutions for people that help us to develop our life skills as individuals, and help us to live better together as *anthropos* in an increasingly digital, connected and complex world.

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NOTES

1. In fact, the question is if *some* human were not already cyborgs long before the digital revolution, with medical devices and aids such as glasses, pacemakers and insulin pumps blurring the boundaries between human and machine.

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