

DISRUPTING THE DEVICE PARADIGM: DESIGNING FOR MUTUAL PRAXIS IN CONNECTED OBJECTS

DESIGNING THROUGH THINGS, TRACK 5

(HOLLY ROBBINS

DELFT UNIVERSITY OF TECHNOLOGY

H.V.ROBBINS@TUDELFT.NL)

ABSTRACT

This paper utilizes Albert Borgmann's framework on the "device paradigm" and argues that it should be considered in terms of connected objects. It argues that connected objects should be designed with an eye towards mutual praxis where users and these objects can grow, mature, and evolve with one another. Borgmann suggests a path of reform to the device paradigm that argues that technologies need to be recast as focal things and practices. We consider two case studies of contemporary technologies that in most circumstances, fall under Borgmann's device paradigm; however in these unique examples, of car modification culture in Cuba and the maker movement, these technologies indeed follow his suggested path for reform. Based on this analysis, this paper argues that a design strategy that utilizes the ability for users to make traces upon their technological objects offers a similar recourse of reform and mutual praxis between user and connected object.

INTRODUCTION

Our world is steeped with interactions between humans and technologies. However, it is often the case that with most technological artifacts, we tend to see the content

the object delivers and are less aware of the object itself. Philosopher of technology Albert Borgmann, argues that this dynamic with technology has unfortunate consequences where the role and the negative impact of the technology itself is obfuscated. He refers to this as the "device paradigm" (1984). Under this paradigm, the technology becomes a "device" which is so abstracted from the context that it is situated in that the only mode for engagement is consumption. The technology becomes an ambiguous and replaceable object whose impact in the user's world is not accessible to the user.

This paper expands on this paradigm to advocate that the dynamic that we have with technological artifacts should be that of a mutual praxis, where the artifact and the user co-constitute one another; in that they can mature, evolve and grow with one another. Further, it argues that the path towards this type of relationship is one that Borgmann identifies, which lies in re-contextualizing technology within our social world, which needs to be supported by practices.

Redefining our relationship with technologies in this way is becoming increasingly important for designers to account for as we continue to surround ourselves with objects that are harvest data from its users, are "connected", and are "smart," even prophetic of, the intimate details of our lives. These objects are by definition designed to be personal objects but are limited in their ability to fulfill other intimate relationships— which are bilateral, and tend to mature, grow, and evolve. Instead, we see contemporary technologies being designed to stay in the realm of Borgmann's devices, without the capacity to achieve this mutual praxis of growing, maturing, and evolving.

This paper will explore the ways of doing, or practices, that emerge among particular subcultures that uniquely provoke this relationship to devices — where we see a mutual praxis performed between user and technology precisely as a result of how the engagement is situated within its ecological context and engaging to users on a social and physical level. Here we will examine how car modification culture in Cuba and maker culture at large

exemplify this transformation from out of device-hood, and how symbiotic relations with technologies are cultivated.

Understanding the dynamics between individuals and technologies within these subcultures can provide designers with future directions to transforming a technological artifact from device-hood towards a mutual praxis. This paper will first elaborate on Borgmann's theoretical framework, and then apply it to two case studies: car modification culture in Cuba and the maker movement. These case studies will be examining if and how this transformation out of devicehood and what qualities of mutual praxis exist. The final section will suggest how these considerations can be applied to design.

POSITIONING

THE DEVICE PARADIGM

Philosopher of technology Albert Borgmann posits that the framing narrative around technology - that it delivers us from strife, toil and burden - is problematic (1984). He argues that the manner in which some technologies are designed ultimately disengages the user from its the complex ecology of social, bodily, skill, mechanical, and material context, and the task it is intended to fulfill, is situated in. He refers to the consequences of this shift as the "device paradigm".

To illustrate this point, Borgmann uses the example of heating systems. Historically, the fireplace has been situated as the center of the home, as a social and logistical focal point—from cooking to heating. Its use marked the cycles of the day and seasons. Maintaining the fireplace requires a good deal of physical and social engagement. The fireplace itself also was a bodily experience. Physical skills were required to cut the wood, lay the logs, and to keep the fire going. This is a sensorial experience from the smell of the smoke, sweat and exhaustion from the labor, and the comfort in the resulting warmth. These skills, bodily and social, are directly linked to how we relate to the world. In Borgmann's configuration, the fireplace is a technology, but it is a "thing" in that it is harmonious with the social ecology surrounding it and that it contributes to deepening and signifying our experiences of it (1984, p. 42; Stolterman & Croon Fors 2008).

Take this in contrast to a "device" that has replaced the fireplace: a central heating system. It is something that is dispersed throughout the house, and does not require skill. We merely turn a dial, a nominal bodily activity that hardly engages us socially. Further, the system's function is masked and the interactions don't give the user a sense of how the heat is produced. Devices are being developed to be more and more discrete, accessible, and easy to use. Thus, it is less engaging in the social and bodily sense as the fireplace. Without this context, we become less aware of how we use it and engage with the technology. For example, we may leave the heater on while we're out of the house without

realizing it, therefore consuming more energy and financial resources than we were aware of.

Borgmann further argues that when a device strips the social cultural context from what it delivers, it becomes a commodity that is ambiguous and replaceable (1984, p54). This can be seen with smartphones. The content of the phone is completely digitized, and thus can be easily transferred from one phone, to a new one. Barriers to replacement are quite low the technological artifact itself is of little consequence.

Devices are purely committed to functionality, and thus the social and ecological context become unnecessary and is therefore reduced. By not demanding much skill or engagement of its users, there is no opportunity for signification beyond the immediate and literal surface level (Stolterman & Croon Fors 2008).

Borgmann suggests that the potential for reform of the device paradigm lies in reorienting the technology towards "focal things and practices". By this he means that the focus of technology has to be redirected to the context that it is situated in and that this needs to be bolstered by practices: "focal things require a practice to prosper within" (Borgmann 1984, p. 196).

To put this back in the terms of the technologies of heating technologies, the fireplace is a focal thing bolstered by practices. It's machinery, how it operates, is completely physical and organizes the practices and social roles around it. Borgmann suggests that the heating system needs to similarly reflect this in order to be a focal thing and practice.

CONNECTED OBJECTS WITHIN THE PARADIGM

Let's expand upon Borgmann's analysis of the heating system. Since he was writing in the 1980's, there have been considerable technological advances; in particular let's address connected objects, or the Internet of Things (IoT), and heating systems. Connected objects are physical artifacts that also have a computational component to them. In the case of IoT artifacts, these objects have an interactive capacity that is somehow enabled by its connection to the Internet.

Perhaps one of the most remarkable and notable products developed within this burgeoning field of connected objects, which is also widely commercially available is actually a device for heating systems: the Nest thermostat. This is a "smart" thermostat that can be controlled via the Internet, but it also is developed so that it learns the patterns of the inhabitants of the dwelling so that it no longer requires the user's manual modification. It adjusts the temperature settings itself according to the cycles of the day to mirror the occupant's habits: lowers itself while people sleep, raises the temperature in the morning, lowers itself after they leave for the day, and raises itself again when the residents return home. It learns the patterns of the occupant's comings and goings and can predict their

behavior and adjust the thermostat accordingly. As a result, human error in forgetting to turn it down or off is avoided, there is a reduction of unnecessary energy consumption and a financial expenditure, and there is no need for user interaction or input.

While this is a clever concept with supreme usability and comfort in mind, it is a device that even further exacerbates the device paradigm. This is a device that is designed to function autonomously of the user, entirely disengaging that person from the social, mechanical, and bodily ecology of the task that the technology delivers. There is a minimalist interface that users can interact with, although it is designed to require little to no interaction with the interface at all. In doing so, it manages to obfuscate the machinery of the heating system even more so. There is an application in which the data from the device can be visualized. However even this further abstracts the system and what it delivers from a social and physical experience.

MUTUAL PRAXIS AND TECHNOLOGY

Within the social sciences and the humanities, praxis is broadly understood as the process or practice by which knowledge, skills, or lessons are embodied or enacted. Within the context of this paper, mutual praxis is used to refer to how people — often described as “users” in relation to technological objects — and things mutually engage and enact upon one another. While Borgmann doesn’t use these specific terms of “mutual praxis”, we can see it taking shape in his analysis. As his theories lay out, the person is shaped by the technology, gradually sharpening their skills, such as becoming more adept at laying a fire. Likewise, we shape the technology as it suits us, for example, we decide if we want to use hardwood or softwood depending on what we want from the fire. The user and the technology are constantly in negotiation with one another, shaping the practice at hand.

Let’s again apply mutual praxis as a critical lens to connected technologies. These technologies are quite close to our person, and connected objects collect more information about our lives than we perhaps fully grasp. Yet the opportunity for mutual praxis is not available. For example with the Nest, it collects data on its users and automatically shapes the behavior of the technology, ideally without any user input. The Nest has been designed to fade into the background. Instead, there needs to be mutual opportunities for the technology and the user to mutually shape one another.

This mutuality is critical. Borgmann specifically addresses that how the technology works needs to be made visible, but so too does our impact upon it. We need to be able to have opportunities for signification of these practices and things. And for connected objects this is even more critical. Without a sense of the way that these technologies work, or how we work with them, the troves of personal data that they collect also become invisible, and then becomes harder for the user to own.

Technological objects can no longer be ambiguous and replaceable devices. It is exactly this replaceable nature of devices that contributes to the 50 million tons of e-waste annually (Vidal 2012). In the following section, we will consider examples where devices are engaged with as focal things and practices so that we draw on these findings for future design work.

CASE STUDIES

Borgmann makes a compelling justification for why technologies should become focal things and practices; but the question remains as to how that can be achieved with contemporary technologies. It is unrealistic to argue that contemporary technologies should be abandoned in favor of some of their more labor-intensive ancestors, such as the fireplace. As connected objects continue to permeate our technological landscape, design should develop perspectives and strategies towards promoting them as focal things and practices over devices.

To begin to consider how this can be achieved, let us first look for examples of contemporary technologies being engaged with as focal things and practices to serve as proof of Borgmann’s concept. From these examples we can extrapolate some themes as to how to achieve this ends in future designs. The two subcultures that we will broadly consider in this section will be the Cuban car culture and that of the maker movement. In these examples, which are on their surface quite disparate, we see the user and the technology mutually shaping one another in a type of mutual praxis that accentuate the social and physical role that these technologies have in relationship to their users.

Understanding how these devices take the role of focal things and practices can begin to give us a sense of how design of connected objects can disrupt the device paradigm. What insights do these subcultures have that can be applied towards designing technological objects that have can mature with their users? Specifically, how can design not only facilitate this mutual praxis, but also communicate and express it?

CUBAN CAR CULTURE

As a result of political and economic circumstances, Cuba is rich with examples of technological objects that are positioned as focal things and practices. In 1961 the United States, Cuba’s principle trading partner, placed severe economic sanctions on the nation. A few decades later in the early 1990’s Cuba again suffered from sanctions from its main trading partner, the Council for Mutual Economic Assistance (COMECON). The result for the small island nation was a loss of about 80% of its imports, which shrank the economy by 34%.

As a consequence, it is commonplace for Cubans to engage with existing materials to create technologies. This can range from making the rationed toothpaste tubes as kerosene lanterns to repurposing the motor from washing machines to power a coconut shredder

(Marder 2015). This so commonplace and widespread that even the military developed a manual (“Con Nuestros Propios Esfuerzos” (With Our Own Efforts)) of crowd sourced ideas on how to manipulate, repair, or reuse everyday objects for how to repurpose rationed items in other building projects (ibid). One device in particular that we will consider here is the car.



Figure 1: Some examples of various objects engineered from rationed items in Cuba, from kerosene lamps from jars and cans to fans made from records and rotary phones. Credit: *Ernesto Oroza from exhibit “Technological Disobedience” at the Miami Science Museum 2014.*

The car is an excellent example of a device. It is a technology that has been developed to disburden us of the process of transportation to such an extent that there is very little social and physical exertion or awareness of the task. Starting a car once involved the cranking of a lever with one’s entire body weight is now more likely to be accomplished through the minimal means of a slight maneuver of wrist to turn the key, pushing a button, or in some cases merely the presence of the key in one’s pocket will start the ignition. Cars are engineered to be low maintenance machines that, in some cases, can even park or drive itself. They are designed to isolate its users, or its passengers, from their physical surroundings—from noise cancelling to climate control technologies. They are increasingly less social and are being used as a single occupant transport option as we see metropolises institute special lanes to promote multiple occupancy commuting. The user of the car is even further removed from the machinery, which has become increasingly complex, and typically requires the expertise of a specialized mechanic to maintain it. In fact, car repair is so notoriously opaque that there is often an anxiety of being taken advantage of by car mechanics.

In Cuba however we see a unique and quite visible relationship with cars. Though personal car ownership is quite low in Cuba with an estimated 400 cars on the island (Warren and Enoch 2010), Cuban roads are peppered with American cars from the 40’s and 50’s that had been imported prior to the US embargo. Cubans have developed clever strategies to keep these machines on the road and operating. As neither new tools nor parts are being imported, handcrafted parts are improvised from whatever is available to them to keep

these technologies running. Part of what makes this possible is Cuba’s free educational system that has produced many highly skilled engineers (Marder 2015).

Here we see a car, typically a device, as a prime example of Borgmann’s implementation of focal things and practices. Modifying these cars to keep them operational requires skill places them as focal things and practices. This type of modification engages the body of the laborer in a great deal of handiwork, and is deeply situated in the social-political climate of the country.

We can see this type of engagement of focal practices around cars happening in other subcultures of modifying classic cars, for example with the hot rod and “low riders” communities in the US. These groups are organized by magazines that offer tips and instructions for modifications, or in meet-ups when their cars and work is shared with one another (Nieuwenhuis 2008). This again is the confluence of the physical (the handiwork and modification) and the social (literature and community meet-ups) transformations of a device into a focal thing and practice.

This transformation is bread out of necessity in the case of Cuba, whereas it is more an act of pleasure and hobby in the US examples. Yet, both are still demonstrative of how engaging with the focal things and practices alter or relations to the device. What we can see is a sense of mutual praxis between users and technology. The functionality and purpose of these tools evolve with their circumstances.

In these circumstances, we likewise see this mutual praxis materially communicated by several means. On the largest scale, we see with the incongruence of the dated car in a contemporary setting. For this to be possible, there clearly is much work that needs to be invested into the machine to make it possible. This can be more explicitly observed with consideration to the improvised parts and tools that keep the car running.



Figure 2: American cars from the 1940s and 50s are kept running in Cuba through creative engineering. Credit: *Creative Commons*

MAKER MOVEMENT

This section doesn't consider the dynamics around a particular technology or device as the previous one had, but instead a subculture that has particular set of principles and attitudes about a mode of production, engagement, and consumption of technologies. To put it another way, the previous section put the emphasis on a focal thing, and considered the practices surrounding it; whereas this section will closely examine a focal practice, and also take into consideration the things that surround it.

The maker movement, which has been considered the "Third Industrial Revolution" (Anderson 2012), is a socio-political response to the production and consumption of goods (Lindtner et al. 2014; Tenenbaum et al. 2013). The maker movement is a subset of the larger do-it-yourself (DIY) movement that highlights individual modification and output as an alternative to the more mainstream model of consumerism that relies on others for manufacturing and fabrication. As the DIY movement is extremely broad and can be parsed into diverse approaches, this section will limit its scope to the maker movement.

The maker movement turns away from mass production and towards individual engagement with the production of objects. If we were to incorporate this under Borgmann's paradigm, it is technically the technology that facilitates production that is the focal thing and practice. This is because of how it firstly is situated in an ideologically charged movement, and secondly requires skills and technology to operate. But here, the focal things and practices extend much further than just the machines of production themselves, and to the process of production and the goods that are produced.

This movement is constituted of "makers" who range in their levels of technical proficiency. They are united by engaging in processes that bind a practice-based approach to learning production, specifically through hands-on doing, with communities of support and shared ideologies. Makers are often united under principles of the democratization of technology and production (Tennenbaum et al. 2013). While the projects and their venues may vary dramatically, they are all deeply rooted in practices of tinkering, exploring and developing skills through doing—a form of practice that Borgmann identifies as critical to the reform of devices. Barriers to production have been lowered by relatively cheap and accessible production technologies such as computer numerical control (CNC) mills, 3D printing, laser cutters, and open hardware platforms (such as the Arduino microcontroller).

We see the maker movement being organized by communities of support, which come in a variety of forms. It can range from online communities that give step-by-step practiced based instructions on how to build certain things or execute some kind of project

(such as Ikea Hackers¹ and Instructables²), or crowd-funding sites (Kickstarter³), to other literature based communities (like the *Make* magazine). There are often physical communal spaces that provide makers with access to tools and peers with diverse skill sets such as hackerspaces and FabLabs (Fabrication Labs) (Lindtner et al. 2014).



Figure 3: FabLab with various communally available tools for production. Credit: Creative Commons

The maker movement is heavily inscribed and united under socio-physical-political principles. Much of the rhetoric around this movement is about the democratization of production to forward a new type of participation and citizenship through making. There is a belief that "making" technology leads to individual empowerment, transforming them from consumers to active participants in the political-economic sphere (Lindtner et al. 2014). Borgmann is also very interested in engagement with technologies and its relationship to democracy, although that discussion is outside the scope of this paper. However, we do see the role that technology plays within the context of the maker movement as satisfying Borgmann's call for focal things and practices. Makers actively engage in practices that disambiguate objects (those that are technologies as well as those that aren't), consumption is no longer the primary mode of engagement with the object. As Joshua Tenenbaum, a scholar of human computer interaction (HCI) who is deeply embedded in this community, explains:

...these (DIY and maker) practices enhance the ability to create personal, contextually relevant technical artifacts using the advances of the industrial revolution in tandem with both traditional and new methods. They obsolesce the notion of the "consumer" as a passive receptor of "products" defined by their function. They retrieve areas of knowledge and

¹ www.ikeahackers.net

² www.instructables.com

³ www.kickstarter.com

practice that are not universally necessary in the industrial age (personal food production, handcraftsmanship, understanding the inner workings of machines), but that bring people pleasure and purpose to know.” (Tenenbaum 2013)

Here we see the mutual praxis of people, materials, technologies, and production are all involved in a mutual process of determination. They are activity engaged with one another in determining the shape and quality of the final product.

This mutual praxis of focal things and practices are materially communicated not only through the establishment of physical spaces and communities of people and resources that share the ideology, but also in the objects themselves. The specialized technologies that are a part of the toolset of the maker (such as a 3D printers, CNC mills, open hardware platforms, and laser cutters) signify his or her work. Here, evidence of the maker’s handiwork is mediated by the specialized technology itself, however the availability and function of these particular technologies implies and expresses the maker’s role.

DISCUSSION

This paper is not advocating for austere economies, or suggesting that everyone has access to the resources (physical, time, and interest) to make all of their furniture or home hacks. Borgmann acknowledges that as technologies become more advance, not everyone can assume expert skills. An engineering education is more accessible to Cubans than those in many other countries, and there are the circumstances where it becomes vital to put it into practice. In the case of the maker movement, is a creative endeavor that comes with a strong political motivation, but is still limited by time, accessibility, time, and interest.

But it is evident in both of these cases, that these forms of engagement with technologies defined them as a focal things and practices. This challenges the device paradigm by facilitating a relationship between user and technology that matures, adapts, and grows—a type of mutual praxis.

The time for technology that promotes mutual praxis is ever present. Consider activity trackers. These are connected sensors and objects that literally live on our person and harvest vast amounts of data. While the data that these technologies collect are the result of embodied skills and interactions of the user, these objects are not yet focal things and practices. These forms of embodiment are not actually directed towards the technology however. Data is a consequence of the skills, but they currently do not engage the functionality of the device. Therefore it is not yet a focal practice. We consume this technology without it being contextually situated as a focal thing. There is a quiet debate raging under the radars of most users of these trackers regarding the privacy of the data that these

devices collect. This is a social impact of the technology that users are removed from. The very nature of the intimacy of this particular relationship with a technology makes renders it as a critical ground for mutual praxis.

POSSIBLE DIRECTIONS FOR REFORMING DESIGN

As was demonstrated in the case studies, material expression of the mutual praxis, helps bring meaning, communicate, convey, and position that focal thing and practice. Making engagement visible in the context of digital materials has already been identified as a critical space for investigation (Wiltse 2014), and urges designers to consider how to implement these in the physical form of connected objects.

A promising design direction that can make use of Borgmann’s suggestion for reform of the device paradigm can be traces. Traces are a manifestation of a type of performance with an artifact. For this analysis, let’s restrict our analysis of traces to physical manifestations of use. Traces require a type of physical skill, physical embodiment, or practice to create— such as breaking in leather shoes or a new baseball glove. Similarly, depending on the interaction that the produces the trace, it can place the object within it’s social context to become a focal thing. The visibility of the trace makes its use, and positioning within our social world, present.

In the case of the leather shoe, we can see how it is used, what types of environments the wearer of the shoe walks through, perhaps also if there is a lot of precipitation, and maybe have some insight to the wearer’s gait. As a result, the leather shoes gives to the particularities of the person who wears it. This is an example of how traces are used in a form of mutual praxis, where the person and the object grows, matures, and evolves with one another.

Traces can serve a layer of communication that can be enabled by designers to help place connected objects as focal things and practices in the lives of their users. This can be a space for signification. It is not just an alteration to the surface of the technology (Stolterman & Croon Fors 2008), but it is the practice that situates the person and the object within the social and ecological context of that object. It is an on-going process of mutual praxis, where the object and the user are constantly engaged in defining one another. Traces can make the relationship and the practices with the technology visible and transforms it into a focal thing and practice. It’s a type of deliberate engagement—which doesn’t require a particular expertise, such as engineering, but can still leave room for skills to develop.

As we can see from the growing interest within the HCI community towards examining the impact of the dynamic that exists among materials, practices and people (Giaccardi & Karana 2015), there is a lot of

potential for traces as a resource for mutual praxis and towards developing technologies as focal things and practices.

CONCLUSION

In this paper, we have examined Borgmann's analysis of the different roles that technology can have in our lives. In particular, we examined his framing of the negative impact that it can have in our lives with his device paradigm, and the avenues for reforming that dynamic that he outlines by returning technologies to focal things and practices. We have expanded on this to emphasize the importance of developing these technologies towards a mutual praxis. We have posited that it is even more critical to reform technologies as they increasingly become connected.

To get a practical sense of how devices are transformed into focal things and practices, the unique subcultures of car modification in Cuba and the maker movement were examined. These examples illustrated the variety of how this transformation can be enacted. Lastly, we offered a possible design direction that draws on engaging the principles behind focal things and practices to prevent future technologies from being developed as devices.

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