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Dataveillance, Design, and the Demise of Interpretive Flexibility

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See table of contents

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Article abstract

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Article

Dataveillance, Design, and the Demise of Interpretive Flexibility

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Abstract

Over the past decade, new technologies have been increasingly deployed in a manner that allows designers to remotely collect usage data, facilitating the development and rollout of updates and adjustments after their release. By retaining control over product stabilization, designers can discourage technologies from being used in manners other than that which they prescribe, thereby reducing interpretive flexibility. As a result, end users are increasingly shepherded towards use-patterns that reflect the interests of designers. This paper explores this agential shift using three case studies. The first considers the evolution of a video game series, exploring how expanding data-collection practices in subsequent releases changed design processes and user experiences. The second case examines the evolution of social media design and the rise of algorithmic nudging. The third case broadly analyzes humanitarian design, demonstrating how dataveillance has expanded beyond consumer electronics. By maintaining control over use-patterns, designers can reduce uncertainty and increase profitability. However, these subtle power shifts also have consequences for user agency and interpretive flexibility, reanimating debates about technological determinism.

Introduction

When it comes to sense-making and sociotechnical interpretation of new technologies, many prevailing understandings continue to bestow power and agency on the end-user; once a technology has been passed into the hands of the user, the designer has relinquished control over it, and end-users are able to interpret and adopt the technology to fit their needs. In this way, stabilized uses, as well as meanings, are established through a process of user-driven sociotechnical contestation. However, for many new technologies, this assumption no longer appears valid; the proliferation of cloud connectivity and use-data collection practices has fundamentally altered how users engage with technologies. Through a proliferation of multi-directional data flows, designers can increasingly observe the ways that their products are being adopted and utilized in real time (van Dijck 2014). Product updates allow designers to develop and implement changes that respond to use-patterns that they observe, giving them control over a technology's stabilized interpretation and use. The ubiquity of cloud-connected technologies challenges many fundamental assumptions of sociotechnical contestation, altering the relationship between technology designers and technology users.

Social scientists have long grappled to understand the influence that technologies have on societies and organizations, as well as the influence that users exert over technologies. Questions of directionality often lie at the core of these debates, resulting in frequent disagreement concerning the placement of carts and horses. Pushing (or pulling) these minor controversies are the competing paradigms of technological determinism and social constructivism. A rich literature has emerged, offering scholars a variety of pathways through which to interpret the design, adoption, and interpretation of new technologies. However,

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much of this literature has been formulated with a particular set of assumptions about designer-user relations that are no longer universally true. Today, cloud connectivity provides designers with oversight over the end uses of many products, rendering the concept of interpretive flexibility increasingly irrelevant. This paper demonstrates how dataveillance has shifted designer-user relations, challenging many existing assumptions about technology and agency.

To begin, this paper will discuss technological determinism and social constructivism while also exploring why dataveillance challenges these approaches. Next, the paper will turn to three different case studies that demonstrate how technology design has changed in the era of cloud connectivity, restructuring relationships between technology designers and users. First, the paper will consider the case of a single product, charting the evolution of a video game from 1999 to the present, demonstrating how design processes and user experiences began to change in tandem with the emergence of cloud connectivity and bi-directional information flows. Next, the paper zooms out a bit, broadly considering the case of social media platforms, demonstrating how product design has evolved alongside data collection practices, reshaping the architectures of social media platforms in order to shepherd users onto more predictable and profitable use-patterns. The final case zooms out even further, examining humanitarian design within the development sector. Here, the paper demonstrates how data feedback regimes have expanded beyond digital products. The final section of the paper brings the cases together, considering what these dynamics suggest for the future of technology design and user agency.

The selection of the three cases is intentional, highlighting the magnitude of the phenomena by exploring it at three different levels of analysis, first through a single product, then through a product category, and finally through an entire sector. This is intended to demonstrate how data feedback has become ubiquitous within a range of disparate design processes. By starting with a single product, we zoom in on the concept of user agency, demonstrating how exactly data feedback loops disable user-driven product stabilization. In zooming outwards to a product category, we can then demonstrate how these same architectures have allowed companies to incrementally update products in a manner that prioritizes the interests of designers over the interests of users. While the first case focuses on the mechanics of the design-feedback regime and the reduction of interpretive flexibility, the second case focuses more on the implications of this power shift and the prioritization of profit-motivated interests within product stabilization. Finally, by looking at technology design trends within the humanitarian sector, the third case demonstrates how data feedback regimes have challenged interpretive flexibility beyond the digital. Viewed together, the three cases provide compelling evidence of a subtle power shift that has occurred within the sociotechnical dynamics of societies.

It's important to note that the use of the term "designer" in this paper does not simply refer to the crafty individuals who tinker and toil over new technologies but rather refers to collective groups of corporate-associated actors who together make decisions about product design in concert. In addition to product engineers and architects, these groups also include managers, lawyers, data analysts, and other tertiary roles whose inputs influence design processes. In the modern corporation, these constellations of actors are often beholden to shareholders, and their behaviors and decision-making processes are often constrained by corporate strategy. Designers, as they are described in this paper, should thus be regarded as complex groups of actors that share a common responsibility for product outcomes, rather than as individual visionaries.

Technological Determinism and Surveillance Capitalism

A persistent question among scholars of technology concerns the directionality of influence when it comes to humans and technologies. Theories of technological determinism dominated the early twentieth century, positing technology as the driving force determining social, cultural, and economic outcomes. Civilizational eras have long been named after a dominant materiality (e.g., stone, bronze, iron, steam), suggesting technology's defining role in shaping societies (Arendt 1958: 144). Before the advent of digital information

technologies, a general consensus existed that technology and social development were causally linked. Karl Marx for example, famously argued that the construction of railroads in India would "dissolve" the caste system (Heilbroner 1994: 70), while Lenin viewed electrification as a key enabler of Communism (Wyatt 2008: 168). By the latter half of the twentieth century, however, the social sciences had begun to develop more nuanced approaches and analyses to challenge technological determinism. Social constructivists elevated the status of the end user, bestowing upon them the power of interpretive flexibility and a substantial degree of influence over stabilized uses of technology (Kline and Pinch 1996; Rosen 1993). Interpretive flexibility is perhaps best defined as "the capacity of a specific technology to sustain divergent opinions" (Sahay and Robey 1996: 260). Social constructivists argue that these divergent opinions arise thanks to the social dimensions of technologies, and emerge via a technology's mediation through social interactions, structures, and representations (Pinch and Bijker 1984). A common theme is the co-construction of users and technology (Oudshoorn and Pinch 2003).

Increased legibility of human-technology interactions, however, enables processes of categorization and sorting that empower designers (Lyon 2005). Over the past decade, the proliferation of cloud connectivity, use-surveillance capacities, and normalized data collection practices have fundamentally changed the relationship between technology designers and technology users (Raley 2012). A deepening of data flows now allows designers to actively observe the ways that their products are being utilized through remote data collection practices. By processing use data, designers can respond to use-patterns that they observe in their products and implement desired changes by rolling out updates. As a result, the past decades have seen a gradual power shift, giving designers more power over how technologies are used while reducing interpretive flexibility. With A/B testing in live products, an increasingly prevalent tool in technology design and deployment, the changing relationship between designer and user becomes even more evident as users are transformed into research subjects within a continuous design process (Christian 2012). As this paper will demonstrate, stabilization has increasingly become a function of technology designers, who maintain an ability to herd users into more desirable use patterns.

The ability for designers to observe users in situ can be interpreted as part and parcel of a broader trend of business practices often referred to as surveillance capitalism (Zuboff 2019). Under these business models, consumers are no longer interpreted as mere static entities that respond to new technologies. Rather, they are enrolled as active participants in progressive design processes premised on behavioral plasticity. Previously, technology design involved iterative processes whereby designers gradually molded technologies to better fit the goals of users. However, with the potential for user surveillance and live product modification, designers can increasingly mold user behavior to better fit the goals of designers, suggesting a power shift that empowers designers and disempowers users. The work of Steve Woolgar (1991: 89), who identifies power within design processes, is of relevance here, demonstrating how testing processes enable designers to "configure" users in ways that result in "a machine that encourages only specific forms of access and use." Today, cloud-connectivity and user-surveillance means that the testing phase only ends when the designer decides that the testing phase ends, calling into question the social constructivist perspective that human action shapes technology and not vice-versa.

In most cases, users retain an illusion of agency in their adoption and interpretation of a technology, while in effect, their use is monitored and analyzed by designers who hold the capacity to intervene. Data feedback loops operate as a "silent" technology—their functionality is hidden within products and they operate passively with limited human involvement (Introna and Wood 2004). Users are typically unaware or indifferent that designers are observing how their products are used, and product updates are often installed automatically in the background. In the context of an update, most users are likely to be unaware that their choices may be quietly restricted. Product users are unlikely to notice that updates might be subtly herding them into certain use-patterns. In many cases, updates are likely to result in most users having a more fluid experience with the technology. Updates often respond to bugs and hiccups that users encounter, solving

potential problems before additional users may encounter them. From the designers' perspective, power over interpretive flexibility can translate into increased product satisfaction and profitability.

The relative power of designers has increased over the last decade, thanks to the increasing availability of artificial intelligence/machine learning (AI/ML) tools. By applying algorithmic techniques to big data sets, it is often stated that designers are able to understand users better than they are able to understand themselves. The abilities of designers to shape user behavior are described by legal scholar Antoinette Rouvroy (2012) as "data-behaviorism," which broadly encompasses the predictive modeling of human behavior based on collected data. This modeling allows for data-informed interventions that can more effectively steer behavioral patterns in desirable directions. What emerges is a new sort of technological paradigm in which user-surveillance and choice architecture are defining characteristics (Dosi 1982; Thaler, Sunstein, and Balz 2013; Zuboff 2019). The use of dataveillance in design fundamentally shifts the needle in our understanding of how humans and technologies interact with each other. As the subsequent cases demonstrate, design processes that steer human-technology interactions tend to follow an internal logic of efficiency, breathing new life into the concept of technological determinism.

Case 1: Nintendo's *Super Smash Bros*

Shifts in technology design processes are particularly evident in the realm of software. Previously, when software was bought and distributed in physical form (e.g., floppy disks, compact discs), the technologies themselves remained static even while users' conceptualizations and uses of the technologies changed or were socially contested (Orlikowski 2000). Under static distribution models, the role of the product designer ended once a final version of the product was copied onto distribution media. Concerns about use-patterns became the responsibility of marketers, managers, and customer service representatives, who would have to rely upon social or organizational strategies to address problems related to adoption and implementation (Boudreau and Roby 2005). However, with the advent of cloud connected software, concerns about use-patterns are increasingly addressed via technological updates deployed by designers who play an ongoing role in the adoption and use of new technologies. In the realm of software, there is a clear delineation between an era when products were released in their final version and distributed via cartridge or CD, and the current era when most PCs and gaming consoles are connected to the internet and products are downloaded and receive regular updates from designers. With physical media, once products were released to the public, they were considered a finished product. Today, however, digital products are shipped with code that enables the collection of anonymous use data, along with lengthy end-user license agreements (EULA), which users are asked to read and agree to in order to use the software. These agreements typically allow for the collection of anonymous use-data and explicitly stipulate that software products are not transferred but rather are licensed to users who do not have "ownership" over products.

To demonstrate the influence that the data collection/feedback regime can have on use-patterns of technology, this section draws upon the popular Nintendo video game series Super Smash Bros (SSB). The first *Super Smash Bros* (*SSB64*) was released in 1999 for the Nintendo 64 system, and it was followed by *Super Smash Bros Melee* (henceforth, "*Melee*") for the Nintendo Gamecube system in 2001 and *Super Smash Bros Brawl* (henceforth, "*Brawl*") for the Nintendo Wii in 2008. These three programs were distributed on physical media under traditional models such that use-data was not collected and the products received no updates. *Super Smash Bros 4* (*SSB4*) was released in 2014 on both the Nintendo 3DS and Wii U platforms, and *Super Smash Bros Ultimate* (henceforth, "*Ultimate*") was released for the Nintendo Switch in December 2018. *SSB4* and *Ultimate* have been designed such that data sharing is turned on by default, although users have the option to navigate through settings menus to turn off data sharing. The two most recent versions of the software are also designed to receive software updates.

While the original *SSB64* was a major hit on its platform (Nintendo 64), the series really took off with *Melee* (Nintendo Gamecube), which attracted committed communities of active users. As players became more

and more familiar with the mechanics of the software, proficient users began to develop new advanced strategies that gave them advantages in their gameplay. Many of these strategies were based on glitches in the software that were unintended by the software developers. These include techniques such as "Wavedashing" (a diagonal air-dodge into the ground that results in the character sliding across the screen) and "L-Canceling," (a technique involving the shield button that allows faster recovery when landing during an aerial attack). These techniques are difficult to learn and master but become important once a player reaches a certain skill level. In response to the rising popularity of these techniques, the game designers opted to "fix" the glitches and remove these mechanics from *Brawl* when it was released in 2008. According to a 2008 interview with Masahiro Sakurai, the creator of *SSB*, Wavedashing and L-canceling were intentionally removed from subsequent versions of the game in order to help counter what designers perceived as a growing gap between beginner and expert players (Hoffman and Thomason 2008). To further close the gap between beginners and experts, the game also added a set of mechanics in which players have a small percentage chance of tripping while dashing. Although *Brawl* was released with much fanfare, the game quickly diminished in popularity as expert players gradually migrated back to *Melee*, which they considered to be a superior product. Within the *SSB* community, players were frustrated that the designers had reduced much of the metagame, complexity, and precision that makes the program fun for advanced users.

With the introduction of an internet-connected console system and data sharing, the dissonance that emerged between perceptions of users and designers would be avoided in *SSB4*. Rather, designers were able to make changes to the game based on analysis of use-data collected from millions of software users. Between November 2014 and July 2017, Nintendo released a total of fourteen different updates in which they tweaked the software to address character imbalances, glitches, and functionality issues. In general, the community received these subsequent updates with neutral or positive reactions. Often, these gameplay updates included the addition of new characters or levels, which contributed to positive reactions. A similar data-informed system of updates was included with *SSBU*, which received twenty-eight updates in the product's first three years. To illustrate the extent of these adjustments, the games first major update (Ver. 2.0.0) included 139 different adjustments to game characters. With each update, designers not only patch user exploits that make certain characters too powerful but also strengthen weaker characters to make them more fun to play with, resulting in a more balanced game experience for most players. However, for many advanced players, updates are often met with frustration, particularly when winning strategies that they have developed are removed from the game. In the wake of an update, online forums tend to be full of complaints, with users often stating "RIP [charactername]," when a preferred character is debuffed.

The introduction of data collection and product updates in *SSB4* and *SSBU* helped the games to avoid many of the problems that Nintendo faced following its release of *Brawl*. What resulted was a balanced and enjoyable experience for most users. However, at the same time, surveillance of product-use patterns also reduced the possibility for users to discover new and interesting ways of playing the game. Much of the reason that *Melee* remained the dominant version of *SSB* for thirteen years was precisely because of the advanced techniques and metagame that were made possible by small glitches in the software that advanced users could exploit. With data collection and updates, however, the ability for users to take the technology into their own hands is diminished as users are herded into predictable use patterns. Under the current data-feedback paradigm, exceptions are treated by designers as bugs to be patched. Today, when powerful techniques and combos are discovered by users, designers often react by rolling out updates that eliminate the advantages afforded by these newly discovered exploits. Players often refer to these corrective actions as "nerfing," in reference to the popular foam dart gun toys. In *SSB4* and *SSBU*, it is the designers who respond to novel use patterns—with cloud connectivity, stabilization of the technology is in the hands of the designer.

In *SSB64* and *Melee*, it was up to players to discover their own ways to respond to novel techniques and combos—stabilization of the technology was in the hands of the user. Even twenty-two years after its

release, *Melee* retains a loyal fan base as players continue to discover new techniques and strategies that change how users play the game. For example, in 2016, professional esports athlete Hungrybox deployed a new set of controversial strategies with the character Jigglypuff that won him the $14,323 first place prize at the 2016 Evo *Melee* tournament. These strategies were so upsetting to community expectations that, during tournament gameplay, many spectators threw objects onto the stage and chanted "Fuck Hungrybox" in outrage. As professional *Melee* player Bobby Scar notes, "For the melee community, it showed the world that...the game is still evolving... the meta has slowly but surely been progressing because of all these players pushing themselves and the game to the limit" (IGN 2022). In subsequent *Melee* tournaments, Hungrybox's controversial strategies were no longer as effective, as professional players had already developed new methods to respond and counter their effectiveness. For *Melee*, the stabilization process is led by users who have continued to advance the technology for decades, far beyond the expectations of designers.

Over the past decade, the data feedback update model has quickly become a standard feature within the world of video games. Svelch (2019: 1600–1601) describes the phenomena as a type of "protocological power," by which power is exercised via technical protocols. Because protocological control systems operate silently in the background, they represent a form of power that is difficult for users to resist (Galloway 2006). Drawing on cases that span three different platform types (console, PC, and mobile), Svelch (2019) highlights examples of "patch resistance," whereby groups of users have attempted to push back against controversial updates that were rolled out by game designers, achieving only marginal forms of success. However, for the majority of users and technologies, the concept of "patch resistance" is neither salient nor desirable. In the wake of most product updates, a handful of advanced users might take to online forums where they will discuss, complain, or praise the changes that were made to the product. However, most users simply adjust their own use patterns without resistance.

While there are certain characteristics of video games that make them uniquely vulnerable to surveillance and updates, similar challenges to interpretive flexibility can be identified in most cloud-connected technologies. Whether it is the LED console on a smart fridge, the notifications on a fitness app, the cleaning patterns of a robot vacuum, or the user interface of a smart TV, most digital technologies are typically deployed such that designers now retain a certain amount of power over their implementation, interpretation, and use. Products are increasingly designed with data collection capacities and are accompanied by user agreements that authorize sharing of use-data and automatic updates by default. These data practices have become normalized and have expanded from the realm of computers and smartphones to the realms of everyday technologies and the internet of things. As this section has sought to highlight, the ability for designers to update products in response to observed use patterns challenges individual agency and places limits on interpretive flexibility.

Case 2: Social Media

A similar shift of agency away from the user has also occurred on social media platforms. In the early years of social media, users developed many unique ways to use platforms, resulting in novel formations, dynamics, and uses of the technology that were not envisioned by their designers. MySpace, LiveJournal, Friendster, Bebo, and other early social media platforms were characterized by colorful, user-driven communities that created digital social spaces with use-patterns that often defied expectations. However, as social media has evolved, designers have increasingly exerted control over what users see and do on their platforms. Today, the dominant social media platforms are increasingly managed in a way that seeks to optimize targeted advertising revenues (Zuboff 2019). The result is that users are no longer active agents shaping how social media platforms are used, but rather are passive agents whose behaviors within platforms are closely studied by data scientists and product managers whose goals are to tweak the platform to meet certain metrics (McNamee 2020; Monteiro 2019). This section focuses on the evolution of social media design and use over time, highlighting the profit-imperative as a factor that has reshaped the relationship between user and designer, constraining use patterns and challenging interpretive flexibility.

Many of the world's earliest social media platforms were places where users could experiment with web design, inserting their own HTML coding into personalized websites, profiles, and community pages. Perhaps none was as flexible and adaptive as Geocities, which was founded in 1994, and is often regarded as one of the internet's first social networking sites. Geocities allowed users to create their own webpages and to index them within a particular "city," creating networks of websites within different neighborhoods, sorted by subject matter or location. Within five years, Geocities grew to the world's third most popular website, and was purchased by Yahoo! in 1999 for $4.6 billion. The interpretive flexibility of Geocities was virtually limitless, as the platform was specifically designed to empower users as designers. The ways in which people used Geocities were predominantly limited by users' HTML capabilities or by functional limitations of the platform's design templates (Milligan 2017). As José van Dijck (2013: 7) notes, "In the year 2000, the Web that would come to sustain online sociality and creativity was still a vast unexplored territory, where boundaries between different mediated activities had yet to be demarcated. It was a new frontier, a bonanza where rules and laws from the 'old' territories no longer applied and new ones had not crystallized yet."

Before Facebook was founded, LiveJournal (founded in 1999) was another of the internet's largest social media platforms through which individuals would share and comment on updates posted by friends. Countless user-driven activities and novel use patterns arose out of these networks, as users found their own ways to use the platform in support of their own purposes; these purposes included things like virtual salons governed by specific codes of conduct, exclusive clubs complete with bureaucratic rules and hierarchies, and a proliferation of community rituals and traditions governing online participation (Hampton 2015; Lindemann 2005). MySpace (founded in 2003) was known for its extensive customization options that allowed users to design their own internet space, complete with a soundtrack. Perhaps nowhere has seen more novel use patterns than the infamous 4chan, started in 2003, which today remains one of the most interesting case studies of the internet (Nagle 2017; Manivannan 2012). On all of these platforms, technology users shared the design space with software engineers, creating community spaces with unique cultures, rules, and rituals (Hodkinson 2007).

Today, social media use patterns have become increasingly constrained by architectural changes implemented by platform designers seeking to maximize specific metrics. Most users are herded into use-patterns that are algorithmically informed and determined by the users' past behavior. Predictive algorithms are designed to maximize specific use metrics, and a user's "feed" is engineered to maximize the likelihood that a user will engage with the platform in the manner that designers intend. Today, most social media platforms rely on reinforcement learning algorithms in which the system takes actions within its environment and then is "rewarded" for desirable outcomes. In the case of social media, the "environment" is the user, and engagement (e.g., clicks, likes, shares, comments, etc.) triggers the reinforcement reward. To maximize reward, the agent (algorithm) acts on its environment to result in more predictable outcomes, such that over a period of time, the algorithm provides users with content that gradually moves them towards more predictable use patterns. The ability to shepherd users onto more predictable use patterns is something that can be translated into monetary gain via targeted advertising.

The transformation of social media was accelerated via Facebook's 2007 hiring of Sheryl Sandberg away from Google. Describing Facebook's Chief Operating Officer as the "typhoid mary of surveillance capitalism," Zuboff (2019) demonstrates how the company's business model quickly transformed and became centered on the expansion of data collection and the conversion of users' behavioral data into predictions about advertising. Meta's design teams now create products that carefully curate what an individual sees, optimizing predictability and profitability (McNamee 2020). The result is that users are intentionally shepherded through the company's platforms, which algorithmically determine what the user is shown and when they are shown it. For most users, the result is a more fluid and enjoyable experience, as users are provided with content that keeps them engaged and maximizes time spent on the platform. However, the algorithmic shepherding of users also carries implications for user agency and interpretive

flexibility, reducing the ability of users to engage with a platform in a manner that does not align with the platform's goals.

Again, this is not to say that users do not continue to develop unique ways to use social media platforms. Social media continues to be a bastion of human creativity, with novel use patterns emerging every day. Viral trends, new "challenges," and fresh memes emerge constantly on social media platforms. However, as a result of algorithmic shepherding, only patterns that align with a platform's metrics proliferate. The "Tide-Pod Challenge," for example, was a 2017 viral trend in which adolescents filmed themselves eating laundry detergent, and it was followed up by the "Cinnamon Challenge" and the "Ice-Bucket Challenge," cementing a use pattern that continues to this day. Other novel user-generated patterns that have achieved platform success include dance challenges, stitches, lip sync battles, pass the brush challenges, reaction videos, and duets. When novel use patterns generate engagement, they spread algorithmically via platform architectures (Grimmelman 2017). When novel use patterns fail to generate engagement, however, they are algorithmically suppressed. As a result, users are quietly herded towards use patterns that align with the goals of designers. Because these goals are normatively neutral, Meta's platforms are often critiqued for shepherding users onto use patterns that promote polarization and extremism (Lauer 2021). Further, by shepherding users towards certain types of content and by maximizing the time spent on the platform, social media use has also been increasingly associated with adverse behavioral and mental health outcomes, particularly among adolescents (Carr 2020; Chao et al. 2023; Valkenburg, Meier, and Beyen 2022).

Of the many critiques that have emerged surrounding the transformation of social media, perhaps the most salient has come from Cory Doctorow (2023), whose concept of "enshittification" was selected as the American Dialect Society's 2023 Word of the Year. In brief, enshittification begins once platforms reach a certain level of monopolization such that, thanks to network effects, users have no real alternatives, allowing companies to prioritize profit motives without constraints (Doctorow 2024). According to the US FTC's 2021 complaint, Meta's share of the time spent by US internet users on social networking services has exceeded 80% since 2012 as the result of the company's active efforts to neutralize, suppress, and deter competition. A common observation about the transformation of social media is that users themselves have become the product (McNamee 2020; Zuboff 2019). Viewed through this lens, social media has become first and foremost a platform to sell user attention to advertisers. Any interpretive flexibility is thus (algorithmically) filtered through the lens of profitability, allowing only novel use-patterns that advance the platform's advertising goals. The technology itself may be able to sustain multiple interpretations, but only those interpretations that align with the goals of the designer are allowed to proliferate.

Bringing it back to social constructivism, what we see here is a technology that was previously characterized by a high degree of user agency. However, with the introduction of algorithmic data feedback loops, user agency has become substantially diminished as platform architectures increasingly shepherd user behavior towards alignment with certain metrics. As with *Super Smash Bros*, users are herded into use patterns that reflect the interests of designers. In both cases, for most users, the result is a more fluid experience with the technology. However, also in both cases, a subtle power shift has occurred whereby designers rather than users now retain control over the stabilized use of technology. In both cases, user agency is diminished; for most users, it is no longer the user that configures the technology, but rather the technology that configures the user. A similar phenomenon can be found within the third and final case, which will zoom out even further and examine how the data feedback paradigm has spread beyond digital technologies, with similar implications for power dynamics within the social construction of technology.

Case 3: Humanitarian Design

The third case considers design within a sector that has historically witnessed a high degree of interpretive flexibility. Technologies that are provided to precarious populations have historically been among the most common to be "misused" by their target populations, who often adapt them to fit their own unique

circumstances. Mosquito nets given to impoverished populations are frequently turned into fishing nets (Short et al. 2018) ; pickup trucks used by NGOs have been subsequently converted into technicals (Neville 2018); deconstructed agricultural irrigation pumps have been known to find their way into motorcycles and other makeshift vehicles (Radjou, Prahbu, and Ahuja 2012; Sekhsaria 2013); and rumor has it that, on occasion, grain donations will mysteriously turn into beer. However, as this section will demonstrate, these types of happy mistakes are increasingly avoided thanks to surveillance-centered humanitarian design processes that employ users as data subjects in iterative and continuous design processes. Implementation of the data feedback design regime within the humanitarian sector has gradually transferred agency over stabilized uses of humanitarian products away from end users and has allowed designers and donors to retain a certain degree of authority over how the use of technologies progress.

Historically, the introduction of new technologies to precarious populations has been frequently accompanied by novel use patterns, unforeseen by product designers. Take, for example, the introduction of the cell phone. In developing countries across the world, codes were developed involving missed calls, allowing the transmission of basic messages for free. In many places, cell phone minutes also became a banking instrument—a way for individuals to turn cash into a relatively stable digital currency that could also be transferred across distances (Evans 2018). This was of particular importance for communities in remote areas that lacked banking services and ATMs, and also became an important financial instrument for those living in countries experiencing hyperinflation. The use of airtime minutes as a form of currency also found application among corrupt officials as a conspicuous mode of demanding and transferring bribes (Hesse 2007: 211). In conflict zones, the introduction of cell phone technologies has led to the rise of improvised explosive devices (Shapiro and Weidmann 2015). Frugal innovation is so common across the developing world that, in many places, it has its own word to describe it. In Hindi, *Jugaad* refers to innovative fixes that stem from adverse circumstances and has sparked an entire design philosophy (Radjou, Prahbu, and Ahuja 2012). The Swahili term *jua kali* translates as "hot sun" and describes frugal innovation amidst precarity (Daniels 2010). In Brazil, *Gambiarra* refers to improvised technical solutions and intersects with the concepts of "hacking" and "technological disobedience" (Tragtenberg, Albuquerque, and Calegario 2021).

Although these traditions continue to evolve within societies around the world, in the context of humanitarian design, the introduction of data feedback loops has arguably begun to stifle some of the user-driven, endogenous innovation processes that these terms characterize. Mark Duffield's (2019) provocative book *Post Humanitarianism: Governing Precarity in the Digital World* highlights how smart technologies and the logics that govern their use have permeated the humanitarian sector. His work demonstrates how humanitarian design processes within the "cybernetic episteme" are increasingly premised on data feedback loops that are more likely to reinforce a state of precarity than resolve it, because technologies developed as substitutes for a fixed-grid effectively preclude endogenous technological advancement while also operating as surveillance apparati for humanitarian and development industries. As Duffied (2019: 160) describes, "while communities were once encouraged to become self-managing, we now have communities of 'users' who are permanently enrolled in the continuous prototyping of the technologies that govern them." Today, humanitarian design shares many of the logics of surveillance capitalism, advancing predictability, or "control and compliance," through architectural design (Spencer 2016). As a result, humanitarian objects are thus increasingly designed to minimize human agency and are intentionally introduced in a manner designed to ensure predictable application or use.

With the rise of cloud connectivity, the use of monitoring and surveillance technologies have gradually become the norm in the deployment of a range of humanitarian projects (Jacobsen 2015). In particular, the humanitarian sector relies on the ubiquity of smart devices for monitoring and evaluation processes, enabling a high level of sectoral control over humanitarian projects. For example, a project in Kenya to distribute the LifeStraw, an inexpensive portable water filter, involved supplying four thousand healthcare workers with motorcycles, smartphones, and a specially designed app to record the GPS locations of a

million units, along with plans for regular monitoring every six months for ten years to evaluate use patterns (Redfield 2016: 168–169). The rise of the surveillance phenomena is perhaps exemplified by a 2015 UNICEF design competition titled "Wearables for Good," whose winners included a necklace embedded with data storage and an NFC chip that can track a subject's health data. An accompanying report asks, "how might wearables and their companion technologies (e.g. sensors and data) specifically drive adoption or promote behavior change within the existing infrastructure and ecosystem?" (UNICEF 2017). The report goes on to suggest that behavioral tracking devices could also be used to help improve good toilet hygiene and handwashing behaviors. In the context of post-toilet handwashing, sociotechnical solutions that reduce user agency may not necessarily be a bad thing.

Much of the transformation of the humanitarian sector can be connected with the rise of behavioral economics and bears many of the same quantified, metric-driven characteristics of surveillance capitalism that drove the transformation of social media. As Duffield (2019: 182) highlights, "if living on the edge, as reflected in the hard choices made by the precariat, can be recorded and visualized as behavioral patterns, behavioral economics seeks to reverse-engineer this situation through feedback." Indeed, the World Bank's (2015: 81) World Development Report, titled *Mind, Society, and Behavior*, proposes that programs should incorporate "cognitive bandwidth" into their evaluation metrics, suggesting that people are better served if they are not burdened with difficult choices. As with social media, end-users are regarded primarily for contextual observation as their individual behavior is subsumed in continuous design processes. As a result, technologies introduced in humanitarian contexts are increasingly designed to reduce human agency and minimize interpretive flexibility. Technologies are instead designed to support the aims and goals of their distributors by reducing manpower, human interaction, cost, and complication, all while improving the metrics by which successful implementation is measured. Over the past decades, innovation has tended to advance connectivity and data collecting. Subsequently, precarious populations are increasingly treated as subjects of cybernetic design processes in which behaviors are mediated through causal chains that move from action, to analysis and comparison with desired goals, and then back to action, incorporating changes to improve the effectiveness of action.

The data feedback loops that increasingly govern the operation of the humanitarian sector are not radically different from the data feedback loops present in either social media or *Super Smash Brothers*. In a similar manner, the humanitarian sector has also observed a gradual shift of power and agency away from end users. Instead, agency has shifted to designers, who can observe the behavior of users and intervene when necessary. In this way, there is a substantial reduction in the interpretive flexibility of technologies that are introduced to precarious populations in the context of humanitarian intervention. The rise of iterative design processes means that technologies are less likely to sustain divergent opinions. Rather, end users are increasingly shepherded into use-patterns that better align with the goals of humanitarian organizations; donated technologies are less likely to be misused, and systems of governance encounter fewer exceptional cases. Sociotechnically speaking, most users tend to experience more fluid interactions. Fluidity, however, comes at the expense of human agency. Divergent opinions reduce efficiency.

Describing precarious populations as laboratories for new technologies, Duffield (2019) employs the concept of the "boomerang effect" as proposed by Hannah Arendt (1951), who observed that colonial populations were treated as testing grounds for experimental policies or modes of governance that would then later be implemented in Europe. Duffield (2019: 158) argues that these practices never stopped, asserting that "the global South currently functions as an unregulated commercial laboratory for the development of smart technologies and data mining experimentation that would be politically difficult in the North." However, one should also note that experimental modes of governance are not inherently problematic. Challenging certain paternalistic tendencies, variations on the concept of "co-design" have also been increasingly applied within humanitarian projects, incorporating more direct forms of stakeholder input within design processes. Dekker et al. (2022), for example, highlight how the incorporation of co-design principles within algorithmic design results in a more responsible and accountable approach for

developing algorithms that aid in the governance of refugee camps. If collected in a proper manner, "more data" can also be a de-problematizing strategy. Participatory frameworks may offer a way for designers to continue harnessing the power of user data in a way that mitigates some of the neo-colonial overtones of the dataveillant user-as-subject design approach this section has attempted to highlight. Whether or not the principles of co-design boomerang their way back to the global North remains to be seen.

Discussion

On a fundamental level, the primary reason that organizations process information is to reduce uncertainty and equivocality (Daft and Lengal 1986). The processing of user data is no exception. The data-feedback paradigm explored in this paper is ultimately a form of uncertainty reduction, in which organizations aim to steer users towards more standardized or predictable technology interactions. Historically speaking, human behavior has been among the most difficult variables to predict. With the release of every new technology, designers have had to simply cross their fingers and hope that users and markets respond in a positive manner. However, as this paper has demonstrated, this is no longer necessarily the case. The surveillance architectures that are increasingly built into many new technologies not only provide designers with the data to understand how their technologies are being received but also provide them with the ability to intervene and shape how users understand and use their products. In a way, the processes of "informating" and automating that were first proposed by Zuboff (1988) are now being applied directly to technology users vis a vis technology developers. By collecting data on the ways that humans interact with technologies, the human-technology interface is becoming increasingly "informated"—each interaction is translated into a set of data points, allowing designers to analyze and understand human-technology interactions to a high degree. By subsequently modifying technologies to either encourage or discourage certain types of interaction, it's also worth considering that human behavior itself is the target of automation (Stiegler 2018). By many accounts, the spread of the data feedback paradigm described in this paper is a characteristic of the advancement towards what Antoinette Rouvroy (2008: 3) refers to as "ambient intelligence," referring to a ubiquitous data collection infrastructure that contributes towards the reconfiguration of the human experience. The extent of this reconfiguration is something that is only made evident to designers. Individual users remain largely unaware that their technology interactions are being observed and subtly mediated through design processes.

As the presented cases have sought to demonstrate, surveillance-centered design changes how users receive new technologies. Through data collection and user-observation, designers have the ability to optimize their designs in situ and direct users towards pre-determined use-patterns. In this regard, the development phase of technology now extends into the implementation phase and beyond. Previously, firms would rely upon focus groups and product testers prior to a product's release in order to understand how new users might engage with their products. Now, use patterns can increasingly be observed and manipulated post release. In a way, this can be interpreted as designers simply re-asserting control over the technologies that they develop, reflecting an agential shift in the social construction of technologies. However, viewed through the lens of technological determinism, it can also be interpreted as the latest chapter in the incremental progression of technologies exerting sociotechnical control over the technology-mediated behaviors of populations following an internal logic of efficiency. In most cases, the behaviors of technology designers are also constrained by shareholder primacy and the managerial structures of organizations that serve those interests, suggesting that the disembodied forces of capitalism also play a role in emergent practices of data behaviorism (Rouvroy 2012).

Many of the economic gains of the past decades have been fueled by consistent increases in data processing capacities that reduce risk and increase market efficiencies (Harvey 2007). However, these economic gains have also been disproportionately concentrated among a corporate capitalist class that often levies political power at the expense of the public interest. Corporations that rely on forms of behavioral data processing have already taken substantial actions to prevent regulatory interventions that might interfere with their data

processes (Cohen 2019; Zuboff 2019). In many ways, this suggests that the hydra of technological determinism seems to have sprouted another head (Wyatt 2008), this one perhaps wearing the leash of neoliberal technocapitalism. Viewed through a critical lens, it may make more sense to speak of a current capitalist ideology that has shaped the trajectory of technological innovation as well as the sociotechnical power dynamics between designers and users. In this context, the defining feature of this trajectory is the reduction of uncertainty and risk. Again, the user data feedback paradigm is ultimately a tool for uncertainty reduction, allowing for more predictable and profitable deployment of new products and services. It also provides organizations with a higher degree of control over the product lifecycle, allowing designers to either extend a product's lifespan or shorten it in the case of planned obsolescence. In the hands of corporate actors, these capacities empower design processes to better serve the interests of shareholders. In the hands of humanitarian actors, they do much the same thing, allowing design processes to better reflect the interests of donors and stakeholders. In both cases, metrics that can demonstrate or facilitate return on investment (ROI) are increasingly enmeshed within design processes.

This leads us to another set of explanatory lenses, which can be found in the so-called quantitative turn, cybernetic turn, computational turn, and/or algorithmic turn. In brief, over the past four decades, the rise of digital technologies has precipitated an ontological shift across a range of sectors and disciplines whereby numerical epistemologies have become increasingly dominant. More recently, artificial intelligence and machine learning technologies have accelerated these trends. Data science has rapidly become one of the fastest growing occupations across the global economy, as organizations increasingly incorporate computational data practices at all levels of work (Frey and Osbourne 2017). The rise of dataveillance within design processes is a facet of this trend, expanding organizations' data and computational practices beyond the product itself, enrolling users as additional sources of data. In many cases, technology designers themselves are also increasingly data subjects whose behaviors are managed via metrics and other quantitative expectations passed down through organizational hierarchies (O'Neil 2017; Zuboff 1988). In an additive manner, the subsumption of both the user and the design process itself within a quantitative, metric-driven framework shaped by the computational logics of shareholder primacy support the argument for a neoliberal data-capitalist flavored variety of technological determinism.

As new developments in artificial intelligence and machine learning further accelerate these practices, it becomes increasingly important for scholars to consider how design paradigms affect socio-technical outcomes. For example, in the case of behavioral shepherding, prescribed use patterns are likely to reflect the cognitive, cultural, organizational, and social characteristics of designers and their organizations, rather than the more varied characteristics of a diverse user base (Bailey et al. 2013). This is sometimes referred to as "Conway's Law," named after the observations of computer programmer Melvin Conway (1968: 31), who first presented the premise in the 1960s, observing that "organizations which design systems are constrained to produce designs which are copies of the communication structures of these organizations." The concept has since expanded to recognize how computer code and algorithmic technologies can contain subtle biases that may reproduce and reinforce existing inequalities (Noble 2018; Webb 2019). When it comes to technology design, most product decisions are made by upper-class employees of tech companies, living in relatively wealthy regions of highly developed countries. This raises concerns about the potential for new technologies to act as vehicles of cultural homogenization. Viewed in the context of class politics, it also raises concerns about the potential for new technologies to serve the interests of capital over the interests of the working class. In the context of the humanitarian sector, Conway's Law can also be employed as an explanatory factor for the expansion of quantified metrics and the data feedback paradigm within humanitarian design, which follows a neoliberal expansion of public-private partnerships and the rise of NGOs (Dencik et al. 2019; Duffield 2019).

The cases that this paper has highlighted were selected in order to demonstrate the breadth of the phenomenon: from a single product, to a product category, to an entire sector. These cases, however, are far from exhaustive; use data shapes product design and use patterns within a myriad of other products and

industries. The field is ripe for further exploration. The smart-home industry, for example, invites designers into our homes, allowing them to understand and mediate many features of domestic life (Maalsen and Sadowski 2019). When you leave your home, vehicles are now increasingly designed to collect a wide assortment of use data, much of which is used to design (and train) subsequent generations of self-driving cars (Martens and Zhao 2021). The insurance industry is a particularly prolific assembler of behavioral data, including data collected by third parties and purchased through data brokers (Gidaris 2019; Sherman 2021). The rise of streaming industries and media business models heavily premised on data-processing are reshaping how humanity engages with its cultural elements (Eriksson et al. 2019) Across most sectors of the economy, where technologically feasible, extensive data practices are increasingly becoming a new norm. There are many more subtle shifts in power dynamics as well as sociotechnical implications yet to be discovered within societies' evolutions towards ambient intelligence (Rouvroy 2008).

This paper has sought to highlight how dataveillance has arguably resulted in user interactions with technologies becoming much more fluid. Designers can now observe bugs, hiccups, or errors and resolve them in real time as users encounter difficulties with their new technologies; as a result, products feel more intuitive than ever, and user uptake and adoption of new technologies has never been greater. That fluidity has allowed new technologies to become more easily enmeshed with many aspects of human life. However, at the same time, from a more critical perspective, there remains something unsettling about dataveillance, the subtle shepherding of end-users, and their unwitting enrollment in continuous design processes. For now, society seems to have settled into a social contract with product designers, giving up data privacy in exchange for more fluid interactions with technologies. However, this also means giving up a degree of power, reducing end-user agency vis-a-vis interpretation and use. Because technologies are increasingly designed in a manner that reduces their potential to sustain divergent opinions, interpretive flexibility wanes. Barring a radical shift in data privacy legislation, this shift in user-designer power dynamics is unlikely to change. Rather, as data practices continue to become cheaper, easier, and more effective, the next decade is poised to witness an acceleration of these trends.

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