

## **Technofutures in Stasis: Smart Machines, Ubiquitous Computing, and the Future That Keeps Coming Back**

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Technoculture promises eternal novelty, but it is often the same old future that keeps coming back. This article argues that the systemic repetition of imagined technofutures often sustains stagnant imaginaries of social relations embedded in those futures. Recycled visions of the smart office or the robot vacuum cleaner carry with them normative assumptions about relations of labor and gender, home and family, that are sheltered from scrutiny through the language of innovative “disruptions.” Drawing on archival research, I analyze the imagined futures of ubiquitous computing (“ubicom”) in the 1990s, and their resonances in the popularization of “smart” machines today. Ubiomp’s signature promise of disappearing computers rested on a familiar conflation of individualized convenience with freedom—a view of breathless innovation underwritten by a static, ossified imagination of domestic labor or the white-collar office. Such mythmaking reproduces a persistent pattern of one-dimensional thought, in which asymmetric power relations and perverse economic incentives for data surveillance are systematically excluded from the drawing board.

*Keywords: future, innovation, new media, mythology, ubiquitous computing, smart machines, Internet of things, user, technological fantasy, sociotechnical imaginary*

New technologies often derive their novelty from technofutures of old (Marvin, 1988). From robot vacuum cleaners to self-steering cars, present-day imaginations of “smart” technologies directly recycle decades of earlier fantasies and predictions (e.g., Geels & Smit, 2000) to manufacture a sense of plausibility and even inevitability. This article argues that such repetition helps sustain stagnant imaginaries of social relations underpinning those visions. Specifically, I revisit the imagined future of ubiquitous computing during the 1990s, and its reprisal in contemporary visions of smart technologies. Promises of the connected

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office or smart fridge are embedded with underlying assumptions around relations of labor and gender, home and family, which in turn yields persistent blind spots around power asymmetries and the homogeneity of the imagined user. We might think of an ostensibly “random” number generator that seems to yield a novel combination each time, but merely remixes variations of the same from a small and static pool of possible numbers. Our technofutures often produce the appearance of diverse visions while deepening a structural narrowness of seeing.

The social life of technofutures plays a key role in shaping collective expectations of what new technologies can do, what forms of life are felt to be possible or inevitable, and what kinds of standards by which they might be assessed. In their performed present, technofutures are fiction—but the kind of fiction through which power relations are tested and entrenched (Powers, 2020). The strategic invocation of “innovative” futures (Vinsel & Russell, 2020) has been central to how we talk and think about emerging information technologies, from smart cities (Sadowski, 2020) to nanotechnology (Milburn, 2008) and cryonics (Farman, 2020)—and, of course, the wider imaginaries of cyberspace and utopia around the Internet (e.g., Flichy, 2007; F. Turner, 2006) and artificial intelligence (Dreyfus, 2012). Throughout, technofutures serve as *mythologies*: performative practices that knit together prototypes and promises into a coherent worldview (Dourish & Bell, 2011; Kinsley, 2011; Kluitenberg, 2006).

The way we talk and think about “smart” technologies today is also shaped by such recycled imaginations of the technological future. Ubiquitous computing, or ubicomp, emerged in the 1990s as a grand vision for the technological future in which machines would “disappear into the woodwork” and silently fulfil our desires. Today, much of the language, ideas, and signature projects for smart tech directly reprise those of ubicomp. In the process, they also conserve the imagined social relations and subjectivities latent in those visions. The result is a persistent reproduction of blind spots in how technologies are designed and deployed, feeding directly into the disparities of the present. Smart technology and the companies behind them have been subject to extensive public scrutiny in recent years. But even amidst this “techlash,” it is proving difficult to overcome the stubborn endurance of misleading and pernicious myths: for instance, that platforms or data are “neutral” (Gillespie, 2010), or that privacy is an individualized possession that can be traded away for convenience (Cohen, 2013). Analyzing the legacy of recycled technofutures behind smart tech’s present dominance reveals a broader pattern of one-dimensional thought, in which asymmetric power relations and perverse economic incentives for data surveillance are systematically left off of the drawing board.

This article examines the public presentation of ubicomp throughout the 1990s, with particular emphasis on the surviving papers<sup>2</sup> of Mark Weiser, the Xerox Palo Alto Research Center (PARC) technologist widely credited as the father of ubicomp. This “old” technofuture is examined in relation to recent futurist discourse around smart machines and the Internet of Things (IoT). In this account, ubicomp is not so much a font of concrete innovations but rather a technofuture vying for belief and presence in the collective imaginary. Such mythmaking often takes place through what media archaeologists have called imaginary media: unbuilt prototypes, impossible designs, visionary sketches, all of which help shape what kinds of

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<sup>2</sup> The majority of ubicomp-related documents referenced in this article are sourced from the Mark D. Weiser Papers, at Stanford Library’s Special Collection.

technologies that *do* go on to be designed, funded, and built (Kluitenberg, 2006; D. Smith, 2018). The intent here is not to assess and compare concrete technical inventions that emerged via ubicomp (e.g., Abowd & Mynatt, 2000; Takayama, 2017), but rather to identify certain recurring patterns in how “new” information technologies are imagined and conceptualized.

Specifically, I argue that the repetition of technofutures compromises our ability to diagnose and rework the social relations surrounding those technologies (Avle, Lin, Hardy, & Lindtner, 2020). This article schematizes the dilemma through the metaphor of the *waiting room*. Technofutures ask us to build our beliefs and lives in anticipation of what lies on the “other side,” where the promised innovations have really arrived. Meanwhile, we are asked to ignore the problems and inequities that fester in the present—partly because they are implied to be “already solved” in the projected future, and partly through “value-lock” in which technological systems bake in old prejudices (e.g., Bender, Gebru, McMillan-Major, & Shmittchell, 2021, p. 614). The waiting room inverts the futurist positionality from prediction to conservation. Technofutures do not “predict” anything; their job is to performatively overwrite the present and its alternative paths (also see Reeves, Goulden, & Dingwall, 2016). We are all asked to keep on staring through the keyhole at the wonderful future, while perennially stuck on the other side of the door.

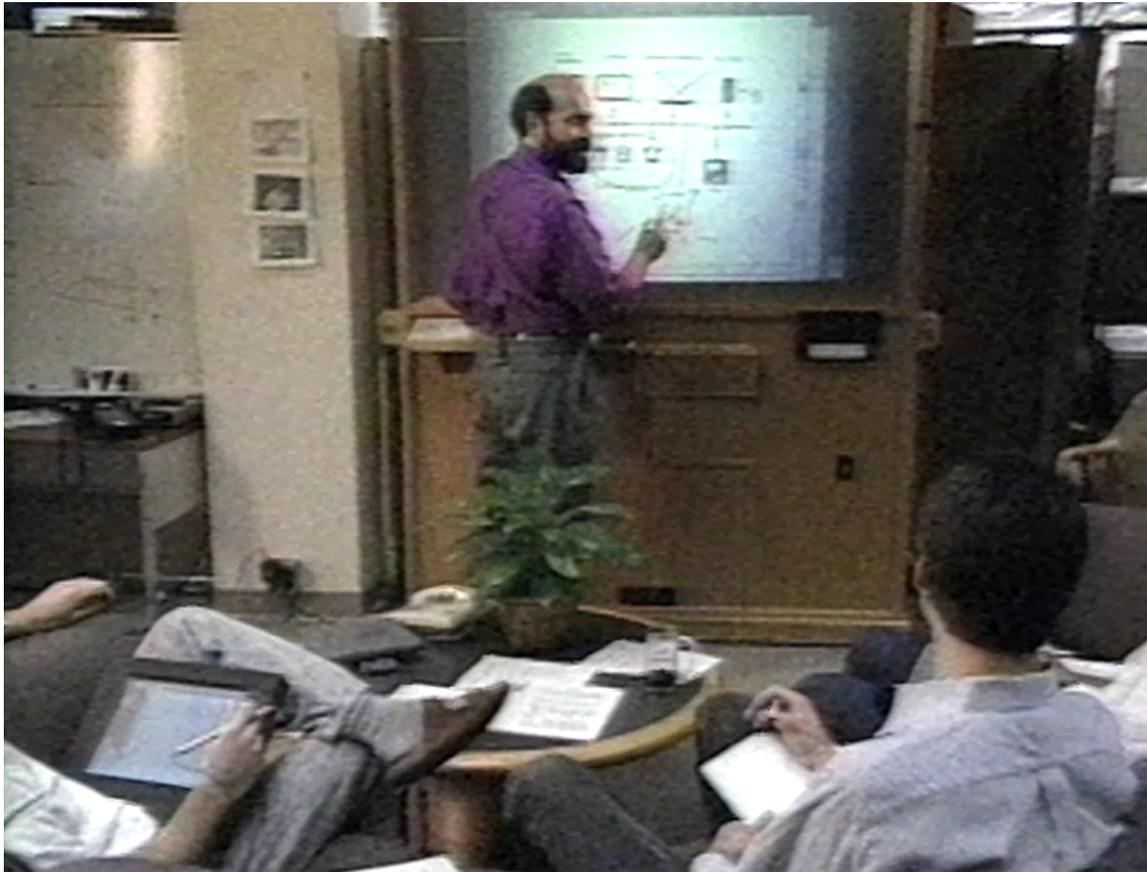
In their analysis of ubicomp, Bell and Dourish (2007; Dourish & Bell, 2011) employ Geoffrey Bowker’s (2006) notion of the *proximate future*—a future constantly promised as just around the corner. The significance of such proximate futures lies not only in the deferral of its promised achievements but also in the concrete losses and disparities that occur in this ever-prolonged “meantime.” In this spirit, I focus on how technofutures from ubicomp to smart tech consistently lean back on the status quo for matters like gender, domestic work, and labor relations. In the “Office of the 21st Century,” a signature site for ubicomp’s visions of the future, we find remarkable gadgets for optimizing the daily routine of white-collar office work—as long as relations of labor and professionalization remain much the same. What is at stake in this repetition and narrowing is not simply what kinds of futures can be “imagined,” but which futures—and *whose* futures—are prioritized with unerring regularity at the expense of which others.

### **The Future Is Now**

“It is too soon to see the future clearly, but we’re predicting by inventing. Make your bets now.”

—Mark Weiser, grant proposal to DARPA, October 27, 1990, p. 6

The year is 1997, and a PBS television special tells us, “The Future Is Now.” As part of an Emmy-winning series titled *Innovation*, host Jim Hartz promises to “preview some of the remarkable technological breakthroughs soon to emerge from the world’s research and development centers” (as cited in Weiser, 2000, Box 134, Othertype 6). Its opening scene shows none other than Mark Weiser, Chief Technologist of Xerox PARC, standing in front of the Liveboard, a large electronic whiteboard that was PARC’s first fully operational ubicomp device (see Figure 1). Weiser is seen annotating freely on the screen with a stylus, while his colleagues co-edit from their seats, large tablet devices resting on their legs. A remote participant also shares and edits the display in real time, and even receives a choppy video feed of Weiser on the side.



**Figure 1. Mark Weiser shows off the Liveboard in 1997 (Source: Mark D. Weiser Papers).**

This demonstration of the Liveboard in many ways exemplified the broader vision of ubiquitous computing. In surviving notes from public talks during the 1990s, Weiser and colleagues spoke of a world in which wirelessly interconnected computers would “disappear into the woodwork.” Files would hop seamlessly from desktop to whiteboard to handheld device as users move through physical space, enabling such “casual, low-intensity use” that we would eventually forget we were using machines at all (Weiser, 2000, Box 65, Folder 9). Such invisibility was expected to not only deliver convenience, but “put human beings first” by redesigning computers to better adapt to human bodies and minds rather than the other way round (Weiser, 2000, Box 93, Folder 51).

But the Liveboard also tells another story about ubicomp as a performative future, vying for a place in the collective imagination of the possible and plausible. Although it was “shipping and generating revenues” (Weiser, 2000, Box 45, Folder 13) by Fall 1993, the Liveboard would prove to be PARC’s only explicitly ubicomp device to reach the market before Weiser’s sudden death in 1999. While the Liveboard was initially envisioned as the first of a series of ubicomp devices, its successors—PARCPad, a large tablet-like device (a prototype is visible in Figure 1), and PARCTab, a smaller peripheral designed for one-handed use—never moved past the

prototype stage. To address this issue, Weiser even left PARC in 1996 to found a startup, Tacit Inc., which planned to develop and sell distinctly ubicomp devices. Its first device, "Minder," was intended to be a device for syncing information across multiple machines, presaging a variety of cloud-based functions today. Yet Tacit struggled to identify a viable market. Just a year later, it had closed up shop, and Weiser would return to PARC.

In lieu of concrete products, ubicomp achieved prominence as a sweeping vision of the future presented with an air of inevitability. Back in the PBS show, Weiser's Liveboard was joined by prototypes like IBM's holographic projections for teleconferenced meetings, and an AT&T/Bell software for voice-controlled flight bookings (which worked reasonably well, as long as the user spoke in clipped tones and in specifically structured sentences—in short, like a machine). Hartz reassured viewers that "systems like these don't exist yet, but aren't far off" (Weiser, 2000, Box 134, Othertype 6). Such public mythmaking was not just a promotional supporting act for the technological project; in many ways, the myth *was* ubicomp. As I describe in the next section, ubicomp's prominence in the 1990s was largely maintained through textual and promissory media, rather than mass market products or patented inventions.

In this context, it is telling that for many, it remained unclear as to what exactly ubicomp was and was not. In April 1993, Weiser hosted a ubicomp workshop for PARC personnel and some external participants, who submitted their diary of experiences to him afterward. These diaries speak most frequently of doubt and confusion. One PARC'er admitted that "I still don't feel like I know [what it is . . . ] much of what was suggested could be done (equally well?) with non-Ubi technology"; another PARC'er thought this was not necessarily a bad thing, exclaiming: "\*Let\* Ubicomp be all things to all people" (Weiser, 2000, Box 52, Folder 17). Indeed, ubicomp's lasting success as an organizing myth was due in part to its ambiguity and flexibility that organizational communication studies call "strategic ambiguity": a means to accommodate diverse views and interests through vagueness (Eisenberg, 1984).

It is precisely as an ambiguous and fungible future that ubicomp could coordinate stakeholders around a common project. By the early 1990s, PARC was being widely described as a once legendary research center that had lost its way, having failed to capitalize on groundbreaking inventions like the graphical user interface in the 1970s and early 1980s. The popular book *Fumbling the Future* (D. K. Smith & Alexander, 1988) helped solidify this narrative (one that Weiser vigorously contested in his own media engagements). Reflecting on his own time at PARC in the late 1990s, Paul Dourish suggests that Weiser's ubicomp was "a way to resolve a management problem as much as articulate an intellectual agenda" (personal communication, April 8, 2019). Indeed, ubicomp would persist as a strategically ambiguous reference point for new generations of technofutures long after Weiser's death in 1999 (e.g., Ekman, 2011; Emerson, 2014). In 2015, Eric Schmidt, then executive chairman of Alphabet, would tell Davos that the future of the Internet is in ubicomp-like invisibility—a world in which there are so many machines, "you won't even sense it" (Dormehl, 2015, para. 3).

### **Mythmaking for the *Scientific American***

Such technofutures leave their mark not so much by delivering on every bold prediction, but by orienting diverse communities toward a common way of talking, thinking, and planning in the present. What is naturalized in the process is not simply the kinds of machines and functions that we come to anticipate, but the imagined user and social environment these technologies are asked to build toward. Emblematic here is

Weiser's (1991) landmark article for the *Scientific American*. Currently standing at over 17,000 citations, the piece remains a, well, ubiquitous landmark imagining and historicizing computing technologies. Wendy Chun (2016) traces the article's call for "vanishing" computers to Vannevar Bush's Memex—that postwar dream of the machine that would remember in our stead (p. 161). Notably, Bush's (1945) "As We May Think" (~9,000 citations), published by *The Atlantic*, was a popular think-piece featuring the Memex as an imaginary machine that was arguably never intended to be built in that exact form. Nevertheless, Bush's piece tapped into and amplified a broader fascination with memory as recall, knowledge as computable information, and the future as the harbinger of total computability (Halpern, 2014; D. Smith, 2018, chapter 4).

Weiser's text extended this tradition of technoscientific mythmaking. In January 1991, Jonathan Piel, the editor of *Scientific American*, approached Weiser and John Seely Brown, the director of PARC, for a piece on "Computer Network Interfaces." Piel explained that what he was looking for was a high-profile agenda-setter, and not just a technical "catalogue of widgets" (Weiser, 2000, Box 46, Folder 1). The issue itself would feature big names such as Vinton Cerf, Alan Kay, and Al Gore. Weiser, who quickly took on the role of sole author, initially dug deep into technical details—including data rates and cell sizes in wired/wireless networks, and proportional logic. Over several months of drafts, assisted by extensive feedback from his PARC colleagues, much of this would be stripped away to yield a short and digestible narrative about the future of computing. The result is the now famous opening line: "The most profound technologies are those that disappear" (Weiser, 1991, p. 94). Indeed, one of the most memorable and oft-quoted parts of the article was the hypothetical scenario of "Sal," a white-collar office worker in the world of ubicomp. Like Bush's stories of how the Memex user might build a "trail" of associative information around Turkish bows or legal cases, the story of Sal, surrounded by smart pens and talking alarm clocks, would stick in the popular consciousness. Translations appeared around the globe, in publications like Japan's *Nikkei Science* and France's *Pour la Science*. Just days after its release, an internal memo by Bill Gates—which somehow made its way into Weiser's hands—had Gates personally recommending the article to Microsoft executives; Alan Kay's piece for the issue, on the other hand, Gates dismissed as "disappointing" (Weiser, 2000, Box 1, Folder 9).

Through all this, Weiser emerged as what van Lente and Rip (1998) call "promise champions": actors who are seen to "speak for a technology, rather than directly to their own interest" (p. 231). Especially after the failure of Tacit, Weiser's days were taken up by an aggressive schedule of talks and interviews, from media outlets to institutions like Procter & Gamble and the U.S. Navy. A *Smithsonian* profile in 1994 dubbed him "one of Silicon Valley's leading wizards" (Wolkomir, 1994, p. 82). That same year, Howard Rheingold, that longtime chronicler of digital futures, provided the redemption arc to PARC's narrative of decline. The title of his *Wired* piece was simple and exuberant: "PARC is Back!" (Rheingold, 1994). Throughout the 1990s, ubicomp's social life consisted of a broad, public vision for the future that might mobilize funding, expertise and belief by furnishing shared "scripts" for a wide variety of potential stakeholders (Konrad, 2006, p. 430).

### **The Waiting Room**

In all this, to say "myth" is not at all to separate fantasy from reality, as if actual technological innovations plod along, disconnected from the mediatized fanfare. Often, the ability to continue "innovating" is dependent on technofutures as performative and mediated mythmaking. The conflation of concrete achievements with grandiose speculations help keep collective belief afloat in the face of temporary

disappointments and foundational flaws. The future is constantly consumed by the present. In the process, the public is often left stuck in a proverbial waiting room.

In an article published by the Institute of Electrical and Electronics Engineers (IEEE), Weiser (1993) confidently stated that “the growing number of researchers working on ubiquitous computing will surmount the daunting technical challenges”—leaving “only” the task of “psychological, social, and business” adaptation (p. 71). But the future never seems to arrive quite on time. In 1990, soon after being hired by PARC, Weiser had filed (and won) a research grant from DARPA to conduct basic research toward an ubicomp future. In it, Weiser confidently projected the outcome of the funded research: “December, 1993. This work ends, the future begins” (Weiser, 2000, Box 8, Folder 2). In 1994, after the expiry of that contract, he would file a new grant proposal for further work needed to realize the “future world” of ubicomp. Its final sentence? “December 31, 1997. This work ends, the future begins” (Weiser, 2000, Box 24, Folder 11). The promised future continued to be cast out onto the next horizon. As David Graeber (2012) has noted, technofutures of the past half-century have often shaped society not by inventing flying cars, but by *promising flying cars that never arrive*, year after year.

To be sure, ubicomp and related research on miniaturized computers, wireless networks and eventually “smart” sensors have eventually delivered many concrete inventions. Yet the constant deferral of the promised future is a normal fixture of this history as well. IoT and smart technologies have been constantly feted as the next big thing, then cast aside as disappointed hype—only to be revived again. During the first decade of the century, smart machines were often dismissed as a technological “flop” seemingly destined for fossilization (e.g., Haskin, 2007). Yet, just a few years later, the same technology was being rehyped as a “big innovation tren[d]” for 2013 (Wadhwa, 2013, para. 6); tech “that will define 2014” (Frog, 2014); or even, one of the decade’s defining innovations that will have “invented the future” (“The Decades That Invented the Future,” 2013). At every juncture, past predictions and achievements are reassessed to naturalize the promises of the present (also see Morrison, 2012).

Such affirmations of technological progress often stretch far afield of concrete proof of efficiency and usefulness. In 2017, a viral Bloomberg story (Huet & Zaleski, 2017) revealed that Juicero, the US\$400 “smart” juicer, could be bypassed simply by taking their proprietary juice packs and squeezing them by hand. The San Francisco-based startup, having previously attracted venture capital funding from prestigious sources like Alphabet, folded in humiliation before the year was out. Cases of both technical and market failures are aplenty: Smalt, a smart salt shaker, can play music—but cannot grind salt. Users of June, a smart oven, have reported devices turning on and heating up at night unbidden, prompting justified fears of midnight conflagration. Such disappointments have given rise to a thriving subculture of parodies by the name of the Internet of Shit.

Yet IoT and smart tech as a broader vision, and a multi-billion-dollar market, continues to grow. In particular, Silicon Valley’s relationship with venture capital, and the attendant culture of confidence games around the funding process, encourages the “simultaneous production of scientific fact and capitalistic value” (Tutton, 2011, p. 413) through such promissory performances. Emblematic is a quotation from Shoshana Zuboff’s interview with a Silicon Valley marketing director:

The “Internet of things” is all push, not pull. Most consumers do not feel a need for these devices. You can say “exponential” and “inevitable” as much as you want. The bottom line is that the Valley has decided that this has to be the next big thing so that firms here can grow. (as cited in Zuboff, 2019, p. 224)

It is precisely through this ability to organize collective perception of a technofuture that, over time, *does* result in concrete achievements—though not necessarily those forecasted in the visions. Imaginary media create time for themselves, generating a sense of legitimacy and plausibility in a future for which the public pays now, and gets later (or never).

Here, anthropological theories of ritual prove instructive, as they have long done for understanding the cultural dimensions of communication (Carey, 2008). Victor Turner (1969, 1982) describes rituals as having a *liminal* quality: Participants take a half-step outside their subject position, outside the ordinary confines of what is sayable and doable, such that they may carefully adjust those conditions. Emblematic are rites of initiation, in which the subject is temporarily taken outside everyday rules of social interaction such that their position in the community may be modified (Suboticki & Sørensen, 2020; V. Turner, 1969). New technologies, too, are normalized through ritual processes for managing meaning, in which alternatives are “defined away” and the interpretation of the technology becomes relatively standardized (Pfaffenberger, 1992, p. 295). The incessant production of prospective discourses helps circulate more speculative kinds of claims, shaping industry decisions and public sentiment while eliding some of the conventional standards for proof and persuasion.

Such a strategic buffer relies on the continuous production of fantasies to maintain a sense of novelty and progress. The waiting room is also a space of spectacle, in which the very consumption of the promise helps unfulfilled technofutures retain their place in the collective imagination (itself an old pattern, as we see in Horkheimer & Adorno, 1989, p. 139). However, this coordination does not entail naïve *belief*. The history of new media adoption amply demonstrates the compromised and reluctant ways in which technical solutions are accepted by everyday users. Many are deeply unsatisfied with the invasion of data privacy, for instance, but feel “resigned” to corporate surveillance as a structural inevitability rather than willingly “trading away” their privacy (Draper & Turow, 2019). Participation in social media platforms is cannily misconstrued as a happy and voluntary choice by consumers in a free market, as opposed to something many feel is becoming an effectively nonnegotiable price of social life and many professional jobs (Vaidhyanathan, 2011, pp. 113–114). In her history of the One Laptop Per Child project, Morgan Ames (2019) argues that technological objects are often invested with Weberian *charisma*, a “compelling force” that persists often despite its inability to fulfil the utopian promise (p. 10). Technofutures often dominate the collective horizon of the possible *despite* broken promises and percolating cynicism.

Rituals achieve their social legitimacy not through the eradication of ambivalence and doubt, but by meeting some minimal threshold for inciting participation (Rappaport, 1999, pp. 102–104). It is not that every churchgoer believes fully and literally in God; it is enough that they continue to attend service every Sunday for whatever combination of half-reasons, publicly exhibiting a minimal level of participation. In this light, the *repetition* of technofutures takes on additional significance. The formulaic recycling of substantive imaginations (such as the smart fridge) increasingly constitutes spectacles of consumption in the Debordian

(Debord, 1990, Section 6) sense. Bratton (2015) argues that popular spectacles of innovation constitute “middlebrow megachurch infotainment” which masks the “cultural de-acceleration” (p. 304) of recycled futures. Consider, for instance, the increasingly spectacular unveilings of new smart technologies. I/O, Google’s annual developer conference, began in 2008, at the typical convention venue of the Moscone Center. Since 2016, they have relocated to the Shoreline Amphitheatre, an outdoor venue usually booked for music festivals and originally designed to resemble the Grateful Dead logo. There, new announcements—such as 2018’s unveiling of Duplex, a smart assistant that makes phone calls on the owner’s behalf—are welcomed with loud cheers from live crowds numbering in the thousands. This regular calendar of previews and launches turns the very act of prediction into an object of anticipation. Stuck in the waiting room, the wonders on the other side constantly deferred, we are encouraged to enjoy the waiting itself (Lösch, 2006, p. 1889).

To be sure, such an account of hegemonic technofutures must also acknowledge the regularity with which its subjects refuse, doubt, and deride those promises. There are high-profile failures (Google Glass), as well as forms of popular dissent and mockery (Internet of Shit). But it is not clear that such criticisms constitute “resistance”—not if we mean resistance as the ability to assert some popular agency over the course of technofutures. The question is not so much whether ordinary subjects genuinely accept an ubicomp or smart vision, but the ways in which their ability to meaningfully choose *against* such visions is effectively foreclosed. Such foreclosure appears far more starkly when we move from relatively idealized imaginations of technological choice, such as the middle-class smartphone user, to more asymmetric scenarios like prison surveillance, biometrics at the border, or worker productivity tracking. Technofutures are rarely democratically elected (or deposed). The very argument that a technofuture has “failed” when it fails to deliver on its promises relies on the belief that its hegemonic status derives from popular approval of a public that retains the power to champion a different vision. But the ongoing repetition of technofutures suggests a more top-down process, in which the recurrent interests (both intellectual and commercial) of a narrow elite continues to shape the collective agenda. Short of open rebellion (often at a high cost to the participants), the dominant technofuture tends to keep drifting in the foreground.

As these forecasts become a normal fixture of technoculture, their particular *methods* for imagining and predicting has the effect of narrowly constraining the kinds of futures that tend to be produced and recycled. Future visions of ubicomp and smart technologies draw disproportionately on the same few inventions, imagined through the same few ideal use cases. In the waiting room, everybody is crowded around the keyhole, trying to look into the future on the other side while remaining stuck in the present. The opportunity to look through into the future is a seductive one, but one that also traps us into a very partial and manufactured view of the possible.

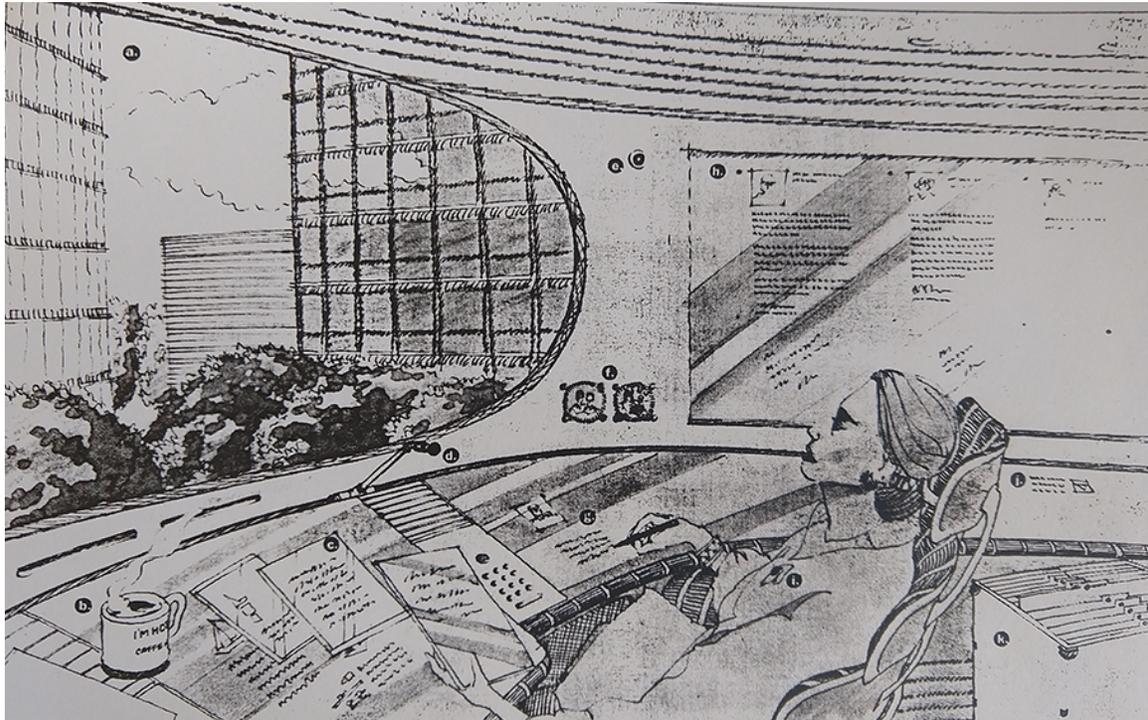
### **The Same New Office of the Future**

In “Progress Versus Utopia,” Fredric Jameson (1982) suggests that the vocation of science fiction is not to “keep the future alive” in the form of Utopia, but to “demonstrate and to dramatize our incapacity to imagine the future [...a] systemic, cultural, and ideological closure” (p. 153). I argue that such closure involves not simply the recycling of particular technical interventions, but an accompanying conservatism in the kind of user and society presumed by those objects.

Specifically, imaginations of the ubicomp and smart future are undergirded by a recurring fantasy that technological convenience equates to human autonomy and freedom. The human subject is articulated as a “greedy” user that can have their cake and eat it: maximally served by technology, and maximally insulated from its influence or costs. Ironically, Weiser himself was keenly aware of the limitations of such thinking. Drawing from philosophy, humanities and the social sciences, Weiser sought to explore different possibilities for how we relate to computing technologies. In one talk in October 1993, he references phenomenology, Karl Polanyi, and feminist “deconstructionism” to argue for a more “contextual” and tacit technology, explicitly refuting any vision of “computers magically meeting our desires” (Weiser, 2000, Box 65, Folder 11). But even as Weiser’s technological promises earned global attention, these normative questions were getting left behind. A *San Jose Mercury News* piece in 1991 illustrated the technofuture in terms of the ultimate couch potato, with sodas delivered by pneumatic tube and pizzas ordered through voice-activated televisions (O’Connor, 1991). Like today’s Uber Eats ads, food is something that simply “appears” on command: no supply chain, no labor, only consumption. A TIME special issue on cyberspace explained that convenience is “at the core of any technological application” (Seaman, 1995, para. 8). Such emphasis on convenience reflects the comforts of a conservative vision in which everything about society remains fundamentally the same, while (whose?) pleasures are maximized through technological efficiency (also see Reeves et al., 2016, p. 11). Today, Silicon Valley luminaries still hearken back to ubicomp’s language of invisible computers, but in a way that obsesses over the “upper crust” of aesthetic and entirely hollowed out of Weiser’s underlying questions. The fantasy comes full circle in the words of Apple’s celebrated designer Jony Ive: “When something exceeds your ability to understand how it works, it sort of becomes magical” (as cited in Emerson, 2014, p. 15).

What emerges in these figurations is a very particular imagination of the individual. For such a user, convenience becomes the master proxy for freedom, agency, and control. Exemplary here is the office, which served in many cases as a default backdrop for depictions of the ubicomp future. The Liveboard was primarily built and marketed for office meetings, as were its intended successors PARCTab and PARCPad. Idealized assumptions around white-collar office work were often baked into these projects and sketches. Consider a *Palo Alto Weekly* piece titled “The Office of the 21st Century” (1992). Parallel to the fictional story of “Sal” in the latter, this piece featured the hypothetical working day of “Kris” in an ubicomp future (Figure 2):

9:47 a.m. As always, the elevator is courteous, welcoming [Kris] by name and whisking her to the proper floor without an additional command. The screen above the door in the elevator lights up. “Kris,” it reads, “as soon as your project analysis is done, don’t forget to send it to me. Thanks. Dianne.” The message attaches electronically to her “to do” list with the simple push of an elevator button. (“The Office of the 21st Century,” 1992)



**Figure 2. The future ubicomp life of "Kris" (Source: "The Office of the 21st Century," 1992).**

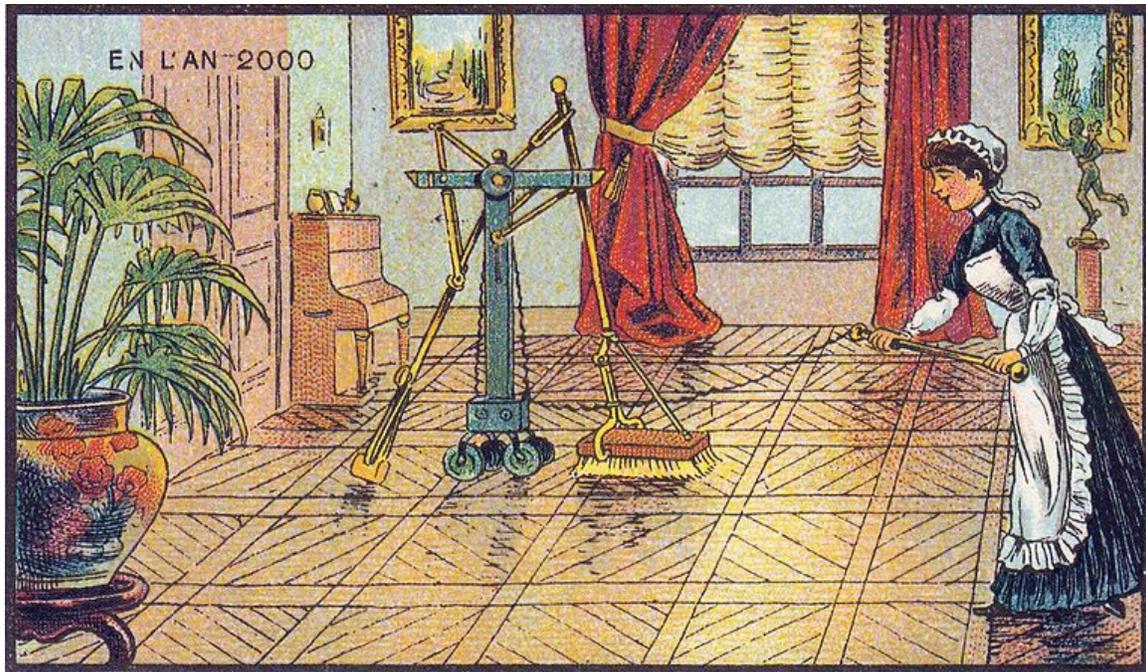
Kris might as well have been a carbon copy of Sal: a white-collar office worker for whom this breakthrough technology primarily works to accelerate familiar activities of booking meetings and e-mailing reports. A Liveboard assists her note taking, and her e-mails can be accessed away from the desk, but there is little that imagines a future of work without a deluge of meetings and e-mails—or any serious consideration of data exploitation, workplace surveillance, and other forms of power asymmetry.

Another familiar fixture for simulating futures is housework. While it did not feature significantly in Weiser's own efforts, subsequent generations of ubicomp research, and especially emerging applications of smart technology over the past decade, have focused on smart kitchen appliances and vacuum cleaners (see Dourish & Bell, 2011, p. 177). Ubicomp's domestic solutions were often motivated by highly visible and archetypically feminized forms of housework, such as cleaning and cooking. Projects like the Tokyo-based "Kitchen of the Future" (Siio, Hamada, & Mima, 2007), in which embedded screens and mics enable functions like recipe retrieval, were common throughout the 2000s. Prototypes for smart fridges also stretch back at least to the 1960s, when a Neiman Marcus catalogue famously featured a "Honeywell Kitchen Computer" administered by the aproned housewife. Honeywell's marketing remained consistent with the midcentury pattern of new household appliances as technological marvels that nevertheless retained familiar gender relations and cultural significance around domestic labor: "If she can only cook as well as Honeywell can compute," read the copy (as cited in Dourish & Bell, 2011, pp. 161–162). In such visions, rationalization is the magic that compresses time, space, and every other kind of cost, freeing up leisure and identity and culture in a supposedly "free" vacuum. Yet Ruth Schwartz Cowan (1976) has shown how the introduction of

new electric appliances into the 20th century American home did not necessarily reduce women's housework hours. Where some labor was indeed saved through machinery, cultural expectations around the "good housewife" tended to create new duties for the woman to fill the gap.

Again, it is the focus on convenience that (ostensibly) smoothes away the pains of existing relations while retaining their basic architecture. It is no coincidence that such designs recycle earlier visions of technologically disappeared housework—and the unchanging figuration of the housewife at the center of it all. To cite just one earlier example, Astra Taylor (2018) describes a "smart" vacuum Hoover had devised in the 1920s. In the absence of miniaturized sensors, the woman would wear a mask to breathe into while vacuuming. A large sack worn on the back would accumulate the exhalations, and the resulting carbon dioxide volumes might provide data for optimizing one's vacuuming routine. The overcomplicated solution of course did nothing to actually improve the lot of the human user, or to "disrupt" the values and expectations embedded in the practice. In fin-de-siècle France, Parisian artists including a certain Jean-Marc Côté produced dozens of illustrated postcards entitled *En L'An 2000*. These depictions of future technologies were intended for the 1900 Paris Exhibition—though production difficulties meant they never made it to the floor. Here, too, familiar social relations and activities are transposed onto a fantastical, yet utterly conservative 21st century. In one illustration, a proto-smart scrubber—a tall, wheeled apparatus with two "arms" handling soap and brush—is seen cleaning the floor (see Figure 3). Yet it also requires the constant supervision of a female servant. Not to worry, explains Isaac Asimov, who later acquired the postcards and published an annotated version in the 1980s. After all, the technological promise is that we can still continue to enjoy the benefits of free domestic labor no matter its exact form:

There was a time when the mistress of the house, having given instructions to the servants, need do *nothing at all*. Of course, the servants had to slave, day in and day out, so if we were *now* to picture the year 2000, or possibly 2050, we could picture intelligent robots doing it all. (Asimov, 1986, p. 71)



**Figure 3. The electric scrubber and human housemaid (public domain, c1899).**

Such conservatism, and the narrow focus on spaces like the white-collar office, arose in part from the kind of *methods* for futuremaking in use. The design process for Weiser's ubicomp was driven by "dogfooding": eat your own dog food, test your own inventions, as a path to rapid iteration. Something of a signature practice for Xerox PARC (though also used elsewhere—e.g., Harrison, 2006), it was a process that deliberately conflated the broader silhouette of the hypothetical user with a narrower figure of the developer-insider (Kilker, 2020). Researchers were encouraged to identify gaps and frustrations in their own everyday life, think about technology's potential for addressing them, and then test the solutions on themselves. Experiments like a proto-smart coffee pot in the PARC building, which would alert individuals in their office when the coffee was ready, specifically responded to the needs and frustrations of the researchers' own environment. Oudshoorn, Rommes, and Stienstra (2004) describe this recurring tendency as *i-methodology*, in which the default to "my" experiences and concerns constantly seeps into the technological design process, narrowing the space of possibilities and allowing these assumptions to pass unexamined. Today, tech design and development still suffer from the same suffocating narrowness of the imagined user. This is not simply a lack of "imagination" that might be solved by more diverse workplaces or clever thought experiments; as Constanza-Chock (2020) notes, our digital economy writ large prioritizes "solutions optimized for the specifications of the most profitable group of users," generating perverse incentives that cannot be overcome through mere "participation" (p. 80).

Such limitations are systematically obscured in the waiting room, where technofutures are endowed with a sense of inevitability. Subsequent decades spent in pursuit of "disappearing" machines have put into stark relief the forms of surveillance and control that were left out of this picture. Consider the question of privacy. Much of the popular discourse around ubicomp in the 1990s filed away privacy as a secondary issue—

in much the same way “smart” tech often does today. In 1997, an ABC Primetime program called *Cutting Edge* put Weiser and ubicomp together with parallel projects in the nation’s premier R&D institutes. Sandy Pentland, co-creator of the MIT Media Lab, argued that wearable computers would in fact provide users with autonomy: “Chips should be put more on the human beings themselves. The future would then be less susceptible to monitoring by outsiders” (as cited in Weiser, 2000, Box 134, Othertype 7). What was consistently omitted in these public presentations were the political economic, organizational, and infrastructural realities. In 1991, one of Mark Weiser’s PARC colleagues provided a handwritten reminder for his draft of the *Scientific American* article: “Somewhere you need to at least acknowledge that privacy issues are a major concern with this kind of technology” (Weiser, 2000, Box 46, Folder 2). The final copy did acknowledge privacy—but barely. It remained a side issue, segregated away from the wider narrative of progress and agency through technology.

Media coverage of ubicomp during the 1990s did raise the specter of a surveillance dystopia, echoing almost precisely concerns around smart technologies today. The *San Jose Mercury News* (“The Boss That Never Blinks,” 1992) asked: Wouldn’t ubicomp contribute to the “steady erosion of workplace privacy in recent years?” A location tracking office badge, *The New York Times* (Sloane, 1992) mused, might be an “Orwellian Dream Come True.” The repetition of glowing technofutures is often accompanied by equally repetitive criticisms. We might reasonably interpret the resilience of such criticism as proof of irreducible popular dissatisfaction with dominant technofutures. Some of these accumulated affects, suspicions, and dispositions were later catalyzed by events like the Snowden affair (Hong, 2020), showing that criticisms which “fail” in the moment might nevertheless cultivate a structure of feeling in the longer term. Yet it is also the case that, like an eternally minoritarian party that everybody knows will never win a seat in parliament, such criticisms have consistently struggled to unsettle the well-funded projection of technological utopia. As forms of criticism themselves become rote and familiar, they are met with well-rehearsed strategies for deflection and co-option. Today, the rapid growth of consumer-oriented smart products continues to rely on similar strategies, relegating privacy to a side effect or arguing that its loss is “worth” the prize of big data analytics. Emblematic is a 2014 *Wired* article—penned by a venture capitalist, and sporting an “#Ethics” hashtag to boot—confidently exclaiming that “sharing your most personal asset [data] may be the best decision of your life” (Seidenberg, 2014, para. 23).

The historical irony is that the success of smart technologies in the past decade is predicated on the turn toward surveillance as the true “user” of such ubiquitous machines. Ubicomp’s utopia invites the assumption that the technology will be optimized to the *user’s* needs and wants, a user seemingly unfettered by societal and institutional constraints. In contrast, the development of smart technologies in subsequent decades has been optimized to capital’s needs and wants *about* the customer, the subject, the data point. Through the burst of the dot-com bubble and the reorganization of what would become the platform economy, and subsequently the rapid popularization of big data analytics, “personalization” in computing has come to address not the personal user, but persons’ data processed for advertisers and data brokers—the true users. Mark Andrejevic (2005) notes that ubicomp and proximate research was, at one point, consuming most of Intel’s R&D budget (p. 110). Such massive investment demands an understanding of the industry, rather than the consumer, as the primary user. The same qualities of invisibility, ubiquity, awareness, operate secondarily for convenience and primarily for extracting data, manipulating behavior, selling on predictions, and ultimately constraining and foreclosing spaces for human judgment (e.g., Cheney-Lippold, 2017; Srnicek, 2017; Zuboff, 2019).

### Futures Lost

The recycling of technofutures, such as between ubicomp of the 1990s and contemporary smart technology, straitjackets the collective imagination around not only what kinds of machines are possible but the social relations undergirding those machines as well. Such performative mythmaking reproduces persistent blind spots around asymmetric power relations in the development of new media technologies. Ultimately, what is at stake is not merely a stagnation of *content*—the same old dreams of flying cars and automatic e-mails—but a stagnation in what kinds of relationships between human subjects and machines (and more importantly, between the individualized “user” and the institutions behind the machines) are presented as normal and inevitable. Mark Weiser hoped that ubicomp would help diversify the technological imagination beyond what he saw as the tyranny of the “personal.” Yet the legacy of such visions today in service of data extraction leaves us with a rather different lesson. The fetishization of the “user” as the locus of technological development consistently downplays the political economic, institutional, and historical interests that feed into these technological futures (also see Hu, 2015, Chapter 2).

The beating heart of such repetition and foreclosure is not located at the level of intellect or imagination: on paper, many technofutures are possible. The bottleneck is instead found in the institutionalized structure of how these futures are produced, legitimated, and repeated, in ways that actively foreclose alternatives (also see Sadowski, 2021). Too often, our technofutures represent not the most “accurate” or popular vision of tomorrow available, but rather the means to entrench existing power relations around domains like labor, family, and of course, consumption (Powers, 2020). The path beyond is unlikely to be found in reforming (and thereby rehabilitating) existing technofutures. What is required is to unpack and dismantle the patterns of production that insist on the same old office, the same old robotic housewife, year after year.

Today, we continue to find familiar blind spots in dominant imaginations of technological neutrality, or AI as a master predictor of human behavior (e.g., Campolo & Crawford, 2020). It remains a crucial task to diagnose and refute these technofutures’ pervasive self-presentation as an inevitable, guaranteed “default” (Hong, 2020, pp. 182–187). Such critical work can help provide a long-term foundation not only for the viability of alternative futures, but also for the possibility of meaningfully choosing against the dominant vision. In the end, a future repeated is not just a future caught in stasis; it is also other futures that failed to be adequately imagined, to be given a fair shot, futures *lost*.

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