Technofutures in Stasis:

Repetition and mythmaking in smart technology and ubiquitous computing

> "Our inventions [...] are but improved means to an unimproved end."
>
> -Henry David Thoreau (2012, 43)

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) in order to manufacture a sense of plausibility and even inevitability. This paper argues that such repetition of technofutures also helps sustain stagnant imaginaries of social relations embedded in those visions. Specifically, I revisit the imagined future of ubiquitous computing during the 1990's and their reprisal in contemporary visions of smart technologies. Promises of the connected office or smart fridge are embedded with a host of underlying assumptions around relations of labour and gender, home and family, which in turn yields persistent blindspots around power asymmetries and the homogeneity of the imagined user.

The social life of technofutures plays a key role in shaping collective expectations of what new technologies can do, which technologies 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 fictions with a tangible impact on both public opinion and

the research communities. Investment and innovation often follow 'on the heels of science fiction' (Jasanoff, 2015), while the social meaning of those inventions are shaped through films and popular media as well (Melley, 2012). The strategic invocation of futures 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 (Chun, 2006; Flichy, 2007; F. Turner, 2006) and artificial intelligence (see Dreyfus, 2012). Throughout, technofutures serve as *mythologies*: performative practices that knit together prototypes and promises into a coherent worldview (see Dourish & Bell, 2011; Kluitenberg 2006; Kinsley, 2011).

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 1990's as a grand vision for the technological future in which machines would 'disappear into the woodwork' and silently serve our needs. Today, much of the language, ideas, and signature projects for smart tech directly reprise those of ubicomp. In the process, they also conserve and repeat the imagined social relations and subjectivities latent in those visions. The result is a persistent reproduction of blindspots in the imagination, feeding directly into the biases and limitations of today's technofutures. Smart technology and the companies behind them have been subject to remarkable public scrutiny in recent years, as part of a broader 'techlash' around the societal implications of new media technologies. One of the key challenges has been 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 individualised possession that can be traded

away for convenience (Cohen, 2013). Inquiring into the legacy of recycled technofutures behind smart tech's present dominance reveals a broader pattern of one-dimensional thought, in which asymmetric power relations or the economic imperatives for data surveillance are consistently left out of the drawing board.

Below, I triangulate the public presentation of these imagined technofutures from multiple empirical sources, with particular emphasis on the surviving papers[1] of Mark Weiser, the Xerox PARC technologist widely credited as the father of ubicomp. I further draw on media discourse and industry advertising around smart home and self-tracking technologies of the 2010's. The intent here is not to assess and compare the concrete technical inventions made between ubicomp of the 1990's and its spiritual successors today (for that, see Abowd & Mynatt, 2000; Takayama, 2017). Rather, it is to identify certain recurring patterns in how 'new' information technologies are imagined and conceptualised. Media archaeology calls our attention to 'imaginary media': unbuilt prototypes, impossible designs, visionary sketches that shape what kinds of technologies are developed with what kinds of use cases in mind (Kluitenberg, 2006, 2011). Failed or unrealised technological designs—or even ones never intended to actually be built—often help shape what is imagined as inevitable or desirable with regards to our technologies. Research on the 'sociology of expectations' has also explored the ways in which promises work 'as currency' (van Lente, 2000), helping coordinate stakeholders towards a common goal while weathering disappointments (Borup et al., 2006; Lösch, 2006; Selin, 2008; van Lente & Rip,

[1] The majority of ubicomp-related documents referenced in this paper are sourced from the Mark D. Weiser Papers, currently held at Stanford Library's Special Collection. The provenance and nature of individual documents are described in-text, while those with available metadata (such as newspaper articles) are cited accordingly.

1998). Many such studies are then aimed at modeling technological change and associated factors, such as market confidence and rate of innovation (e.g. Brown & Michael, 2003; Konrad, 2006; Geels, 2002). And of course, there is a long tradition of studies that assess patterns of innovation *uptake* around the work of Everett Rogers (1962). In contrast, my focus is on how the social life of recycled futures foreclose meaningful scrutiny of the underlying social relations embedded into those visions. It is telling that the Office of the 21st Century, a key thought experiment in ubicomp's visions of the future, is filled with remarkable gadgets for optimising the routine labours of white-collar office work—as long as the meetings and emails, or relations of labour and professionalisation, remain the same.

In particular, this paper draws on the work of Genevieve Bell and Paul Dourish (2007, 2011), and their description of ubicomp in terms of Geoffrey Bowker (2006)'s notion of the *proximate future*: a future constantly promised as imminent, as just around the corner. The significance of such proximate futures lies not only in the deferral of its promised achievements, but what happens in the meantime for a society stuck in anticipation. Extending these views, this article analyses the repetition of technofutures across ubicomp and smart technologies through the metaphor of the waiting room. Technofutures engage stakeholders in anticipation for what lies on the other side—that is, the future realisation of predicted technologies. Meanwhile, we are asked to ignore the problems and inequities that fester in the present, which are implied to be 'already solved' in the projected future. Yet crowded around the keyhole, we find that the heavily mediated image of the future to be a narrow, repetitive vision. At stake is not simply what kinds of futures can be 'imagined', but which futures are prioritised over others in the collective imagination.

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, 27 October 1990

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 centres." 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 (Fig.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.

[FIG.1 – SEE APPENDIX]

This demonstration of the Liveboard in many ways exemplified the broader principles of ubiquitous computing. In surviving notes from public talks during the 1990's, 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. Such invisibility was expected to not only deliver convenience, but help 'put human beings first' by redesigning computers to better adapt to human bodies and minds rather than the other way round.

I will revisit below the substance of ubicomp's vision for the future of computing, and the assumptions embedded into those ideas. But the Liveboard also tells another story about ubicomp as a performative future. Although it was shipping to customers by Fall 1993 and generating revenues, the Liveboard would prove to be PARC's only explicitly ubicomp device to reach the market before Weiser's sudden death in 1999. Initially envisioned as the first of a series of ubicomp devices, its successors—PARCPad, a large tablet-like device, 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 would develop and sell distinctly ubicomp devices. Its first device, 'Minder', was envisioned to be a device that helps sync 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 or landmark breakthroughs in basic research, ubicomp achieved prominence as a sweeping vision of the future presented with an air of inevitability. 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. Buttressing these imaginary media was Hartz' reassuring narration that "systems like these don't exist yet, but aren't far off". Such performative, public mythmaking wasn't just a promotional supporting act for the technological project;

in many ways, the myth *was* ubicomp. Weiser's own breakout moment that sealed his reputation as the 'father of ubicomp' came not with a mass market product or patented invention, but a popular article at the *Scientific American* titled "The Computer for the 21st Century" (1991). Especially after the failure of Tacit, Weiser's days were taken up by an aggressive schedule of talks and interviews. Institutions like Procter & Gamble and the United States Navy invited him to advise on the future of computing, while media appearances on outlets like *The Guardian* (UK) and ABC (US) raised his public profile. Throughout the 1990's, ubicomp's social life consisted of a broad, public vision for the future that might mobilise funding, expertise and belief by furnishing shared 'scripts' for a wide variety of potential stakeholders (Konrad, 2006, p. 430; van Lente & Rip, 1998, p. 234).

In this sense, 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 afterwards. These diaries speak most frequently of doubt and confusion. "So many people said they came to find out what UbiComp is", wrote a PARCer – who then admitted, "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 PARCer chose to see the bright side of the confusion, suggesting: "*Let* Ubicomp be all things to all people." Indeed, ubicomp's lasting success as an organising myth was due in part to its ambiguity and flexibility—a tendency also found in other technofutures like nanotechnology (Lösch, 2006; Milburn, 2008). Ubicomp was an instance of what organisational communication would call 'strategic ambiguity': a way to accommodate diverse views and interests precisely through the vagueness of interpretation (Eisenberg, 1984).

It is precisely as an ambiguous and fungible future that ubicomp could coordinate funding, expertise and belief around a common project. By the early 1990's, PARC was being widely described as a once legendary research centre that had lost its way, having failed to capitalise on groundbreaking inventions—like the graphical user interface—in the 1970's and early 80's. The popular book *Fumbling the Future* (1988) helped solidify this narrative (though Weiser would vigorously contest it in his own media engagements). Ubicomp presented a fresh vision that could hope to restore PARC to the centre of the imagined future. Reflecting on his own time at PARC in the late 1990's, Paul Dourish suggests that Weiser's ubicomp was "a way to resolve a management problem as much as articulate an intellectual agenda." (personal communication to author, 8 April 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, 2015). 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). Ubicomp continued to provide mythological value, quite distinct from its viability or success to date as a research project.

Mythmaking for the Scientific American

The strategic and performative effect of technofutures is not found in the literal realisation of bold predictions, or solely in the concrete technical achievements that might eventually be made. Rather, it is in their ability to orient diverse communities towards a common way of talking, thinking, and planning about the technology at hand. What is naturalised (Pfaffenberger, 1992) in this way is not simply the kinds of machines and functions are

expected, but the imagined user and the social environment these technologies are asked to create. Emblematic here is Weiser's landmark article for the *Scientific American.* Currently standing at over 16,000 citations, the piece remains a, well, ubiquitous landmark imagining and historicising computing technologies. Wendy Chun (2016, p. 161) traces the article's call for 'vanishing' computers to Vannevar Bush's dream of the Memex, that postwar dream of the machine that would remember in our stead. There is another parallel here that Chun likely had in mind. Bush's "As We May Think" (~8,500 citations), published by *The Atlantic* in 1945, was a popular think-piece featuring the Memex as an imaginary machine that was arguably never intended to be built in that form. Though Bush's article had little in the way of technical blueprints for future research, it tapped into and amplified a broader fascination with memory as recall, knowledge as computable information, and the future as the harbinger of total computability (also see Halpern, 2014).

Weiser's text extended this tradition of 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'. From the beginning, it was envisioned as a high-profile agenda-setter. Piel wrote that "rather than presenting a catalogue of widgets, the piece would ask how a computer can facilitate and enrich an exchange between human beings and do so in a flexible and unobtrusive way." 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, worked for months over multiple drafts, assisted by extensive feedback from his PARC colleagues. Notably, much of the technical and theoretical discussion—about data rates and cell sizes in wired/wireless networks, for instance, or analyses of proportional logic—was gradually stripped away to yield a relatively short and

digestible narrative about the future of computing. It was only through this process that Weiser arrived at the now famous opening sentence: "the most profound technologies are those that disappear." 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, virtual offices and talking alarm clocks, would stick in the popular consciousness. Translations would appear around the globe, such in 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—shows Gates personally recommending the article to Microsoft executives. (Alan Kay's article, on the other hand, was dismissed as 'disappointing'.)

Thus put into global circulation, the article provided a reference point for a shared belief in the technofuture—a role also played by Weiser himself throughout the 1990's. Through a steady stream of talks, articles, interviews and profiles, Weiser emerged as what van Lente and Rip call 'promise champions': actors who are seen to "speak *for* a technology, rather than directly to their own interest" (1998, p. 231). In fact, Weiser was deeply committed to bringing on board a wide variety of scholarship, from anthropology to semiotics and Ludwig Wittgenstein to Lucy Suchman (who was his colleague at PARC). Nevertheless, ubicomp's development into a long-running agenda depended largely on the success of his *Scientific American* piece and the ensuing characterisation of Weiser as a visionary. 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)

To say 'myth' is not at all to separate fantasy from reality, as if actual technological innovations plod along disconnected from the mediatised fanfare. Technofutures tend to be ambiguous not only in the sense of what exactly is being predicted, but also in the way that they blend the appearance of concrete, provable claims with more speculative ones. Packaged into consumable spectacles, visions of the ubicomp or smart future afford greater flexibility around what counts as persuasive or plausible—and insulate from scrutiny not only the substantive claims made about technical achievements, but the idealised social relations and ways of life that undergird those projected inventions.

The Waiting Room

In more ways than one, the incessant circulation of recycled technofutures leaves its consumers stuck in a proverbial waiting room. By turning from the projected future to the present that consumes the future, the waiting room emphasises the strategic and political implications of technofutures as performative, mediated mythmaking rather than predictions of future states.

The immediate strategic utility of such mythmaking—for the industry, at least—is to provide a buffer in which the incompleteness of the technology, the inability to turn a profit, the unpreparedness to deal with the many unintended consequences, can be sufficiently mitigated to maintain political support and public enthusiasm. In a 1993 contribution to *Computer,* the flagship publication of the IEEE [Institute of Electrical and

Electronics Engineers] Computer Society, Weiser 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 (1993, p. 71). But the future never seems to arrive quite on time. In 1990, soon after his initial hiring at PARC, Weiser had filed (and won) a research grant from DARPA to conduct basic research towards an ubicomp future. In it, Weiser confidently projected the outcome of the funded research: "December, 1993. This work ends, the future begins." In 1994, after the expiry of that contract, he would file a new grant proposal, for further work needed to realise the "future world" of ubicomp. Its final sentence? "December 31, 1997. This work ends, the future begins." The promised future continued to be cast out onto the next horizon, invoked each time to mobilise funding and belief.

To be sure, ubicomp and related research on miniaturised computers, wireless networks and eventually 'smart' sensors have 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. A computing magazine included 'smart appliances' in a 2007 piece about the "biggest technology flops", deriding the hype around smart appliances back at the turn of the century. "The bubble burst, and we haven't heard much about intelligent appliances since", they wrote (Haskin, 2007). Yet by 2011, the Internet of Things was back in tech advisory firm Gartner's influential 'Hype Cycle for Emerging Technologies' report for the year (Fenn & LeHong, 2011). It would be slated as a technology "that will define 2014"; an innovation predicted to hit big time in 2013; or even, one of the decade's defining innovations that will have "invented the future" (Respectively:

Frog 2014; Wadhwa 2013; Brandon 2013). At every juncture, past predictions and achievements are reassessed in order to naturalise the promises of the present (also see Morrison 2012).

Affirmations of technological progress were not necessarily based on clear and proven cases of useful machines. In 2017, Juicero, a San Francisco-based startup selling 'smart' juicers, folded in one of the most public humiliations of smart gadgetry. A Bloomberg story (Huet & Zaleski, 2017) revealed that Juicero's proprietary packs, made specifically for their 400USD machine, could just as easily be squeezed by hand. Having built its business on venture capital funding from prestigious sources like Alphabet, the company had shut by the end of the year. Cases of both technical and market failures are aplenty: Smalt, a smart salt shaker, can play music—but cannot grind salt. Fitbit, one of the most widely sold self-tracking devices, has been challenged by researchers (Jakicic et al., 2016) and even a lawsuit (*Brian H. Robb v. Fitbit Inc., et al.,* 2016) over the basic accuracy of its exercise tracking measures. Users of June, a smart oven, have reported devices turning on and heating up at night unbidden. Such disappointments have given rise to a thriving subculture of parodies by the name of the Internet of Shit.

Yet IoT and smart technology as a broader vision, and a potentially multi-billion-dollar market, continues to grow. By managing the broader narratives around technological change, technofutures can influence the standards by which success or failure is assessed, providing a kind of 'protective space' from scrutiny (Konrad, 2006). Fictions of the future are used to gloss technology in unreal ideas and expectations—and then quarantined away when no longer a useful source of legitimacy and enthusiasm (see Milburn, 2008). Individual entrepreneurs or products may fall from grace, but the broader commitment to a 'smart'

future is maintained. Silicon Valley's particular 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" through such promissory performances (Tutton, 2011, p. 413; also see Shapin, 2008, Chapter 7). Emblematic is a quotation from Shoshana Zuboff's interview with a Silicon Valley marketing director (2019, p. 224):

> 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.

It is precisely through this ability to organise collective perception of a technofuture that, over time, *does* result in concrete achievements—though not necessarily those forecasted in the visions. Imaginary media thus 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, 1975). Victor Turner (1969, 1982) speaks of the *liminal* quality of rituals. Participants take a half-step outside the ordinary confines of what is sayable and doable precisely so that they may adjust those conditions. Emblematic are rites of initiation, in which the subject is ritually placed outside everyday rules of social interaction such that their position in the community may be modified (V. Turner, 1969; also see Suboticki & Sørensen, 2020). New technologies, too, are normalised through ritual processes of meaning-managing, in which alternatives are

'defined away' and the interpretation of the technology is standardised (Pfaffenberger 1992, p. 295). The incessant production of prospective discourses, from Weiser's article to the annual trade show, help circulate more speculative kinds of claims, shaping industry decisions and public sentiment while eliding some of the conventional standards for proof and persuasion.

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Such a strategic buffer relies on the continuous production of fantasies in order 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 Adorno & Horkheimer, 1989, p. 139). However, this coordination does not entail naïve *belief* in which the subject emerges as a wholehearted champion of the mythological future. 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 (Turow et al., 2015). 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 non-negotiable price of social life and many professional jobs (Vaidhyanathan, 2011, pp. 113–114) We need not be fully convinced about the given technofuture in order for it to dominate the collective horizon of the possible.

Rituals achieve their social legitimacy not through the eradication of ambivalence and doubt, but by achieving the minimal thresholds to incite 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, exhibiting their participation to themselves and others. In this light, the *repetition* of technofutures takes on additional significance. The formulaic recycling of substantive imaginations (such as the smart fridge) increasingly constitutes spetacles of consumption in the Debordian (1990, Section 6) sense. Benjamin Bratton argues that popular spectacles of innovation constitute 'middlebrow megachurch infotainment' which masks the 'cultural de-acceleration' of recycled futures (2015, p. 304). 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. There, new announcements—such as 2018's unveiling of Duplex, a smart assistant that makes calls on the owner's behalf—are welcomed with loud cheers from live crowds numbering in the thousands. This regular calendar of spectacles 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).

As these forecasts become a normal feature of technoculture, however, their particular *methods* for imagining and predicting has the effect of narrowly constraining the kinds of futures are imagined 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 subject into a very partial and manufactured view of the possible.

The Same New Office of the Future

In "Progress versus Utopia", Fredric Jameson suggests that the vocation of science fiction is not to "keep the future alive" in the form of Utopia, but to "demonstrate and to dramatise our incapacity to imagine the future [...a] systemic, cultural, and ideological closure" (1982, 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 will equate to human autonomy and freedom. The human subject is represented by a 'greedy' user that can have their cake and eat it: maximally served by technology, but insulated from its influence or costs. Ubicomp was envisioned as a technology that is so discreet that it would free users to pursue their true interests and desires. But what is telling is that even as Weiser's visions would become embedded into the prospective discourse around computing for decades to come, the questions he posed about a different way of relating to technology tended to get left behind. Weiser frequently drew on a range of philosophy and humanities scholarship to explore different ways of relating to machines. In one talk in October 1993, he cites from 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". Yet media coverage of such technologies tended to perform exactly this flattening of innovation into convenience. 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. A TIME special issue on cyberspace explained that convenience is "at the core of any technological application." (1995) By the 2010's, Silicon Valley luminaries from longtime Google CEO Eric Schmidt to famed Apple designer Sir Jony Ive would hearken back to ubicomp's language of invisible computers, but shorn almost entirely of those underlying considerations. The fantasy comes full circle in Ive's description of the iPad mini: "when something exceeds your ability to understand how it works, it sort of becomes magical." (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 privileged proxy for freedom, agency, and control. Exemplary here is the office, which served in many cases as the default background for depictions of the ubicomp future. The Liveboard, the one explicitly ubicomp device to make the full journey from PARC's design meetings to the market, was primarily built and marketed for office meetings. Its intended successors, the PARCPad and PARCTab, were also tested for office use, and hoped to facilitate existing information flows such as e-mail and meeting scheduling. A set of idealised conditions around white-collar office work was 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 (Fig.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.

Kris might as well have been a carbon copy of Sal: a white-collar office worker for whom this breakthrough technology primarily works to lubricate familiar activities of booking meetings and emailing reports. A Liveboard assists her note-taking, and her emails can be accessed away from the desk, but there is little that imagines a future of work without a deluge of meetings and emails—or any serious consideration of data exploitation, workplace surveillance, and other forms of asymmetric power relations. In its own articulation of the problem, the only kind of subjugation ubicomp needed to prevail over was humanity's immature dependency on the machine.

[FIG.2 – See Appendix]

Another familiar fixture for simulating technofutures was housework. While it did not feature strongly in Weiser's own efforts, subsequent generations of ubicomp research, and especially emerging applications of smart technology in the 2010's, have focused on smart kitchen appliances and vacuum cleaners. Dourish and Bell have thus noted a "remarkable preoccupation with self-cleaning systems and robotics" (2011, p. 177) in ubicomp research. Ubicomp's domestic solutions are often motivated by highly visible and typical forms of

femininised housework, emblematised by cleaning and cooking. Projects like the Tokyo-based 'Kitchen of the Future' (Siio et al., 2007), in which embedded screens and mics enable functions like recipe retrieval, were common throughout the 2000's. The aforementioned repetition of smart fridges goes back at least to the 1960's, when a Neiman Marcus catalogue featured a "Honeywell Kitchen Computer" for managing recipes, administered by the aproned housewife. Honeywell's marketing remained consistent with the mid-century pattern of new household appliances as technological marvels that nevertheless retained familiar gender relations and cultural significance around domestic labour: "if she can only cook as well as honeywell can compute", read the copy. In many such imaginary products, "the messiness of daily life was replaced with a vision of technological order" (Dourish & Bell, 2011, p. 166). Rationalisation 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 the work of Ruth 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 labour was indeed saved through machinery, cultural expectations around the 'good housewife' tended to create new labours for the woman to fill the gap.

Again, the convenience provided by new technologies give the appearance of smoothing away the pains of existing relations of labour or gender 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 centre of it all. To cite one earlier example, Astra Taylor (2018) describes a 'smart' vacuum Hoover had devised in the 1920's. In the absence of miniaturised sensors, the

woman would wear a mask to breathe into while vacuuming, and accumulating it into a large sack worn on the back, so that the CO_2 volumes might help optimise 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 congealed into that category. 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, intended for the 1900 Paris Exhibition, would later be acquired by Isaac Asimov, who compiled them in a book named *Futuredays* (1986). Here, too, familiar social relations and activities are transposed onto the 21st Century. In one illustration, a 'smart' scrubber – a tall, wheeled apparatus with two 'arms' handling soap and brush – is seen cleaning the floor (Fig.2). Yet it also requires the constant supervision of an aproned housemaid, who appears to wield a rod tied to the robot to guide its movements. Asimov isn't terribly concerned: in the past, ladies found a way to completely liberate themselves from housework through the use of servants – and surely, in the future, we will achieve the same through technology (Asimov, 1986, p. 71):

> 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.

[FIG.3 – SEE APPENDIX]

Such conservatism, and the narrow focus on spaces like the white-collar office, arose in part the kind of *methods* for futuremaking in use. The design process for Weiser's ubicomp was driven by 'dogfooding': eat your own dog food, use your own invention, as a path to rapid iteration. Something of a signature practice for Xerox PARC (though practiced 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. It is in this particular sense that ubicomp was a deeply *personal* project for its progenitors – a 'personal' reflected in both ubicomp's attentiveness to user autonomy and the narrowness of that imagined user.

The limitations of such a homogenous imagination are 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 1990's filed away privacy as a secondary issue—in much the same way the 'smart' industry would in the early 2010's. In 1997, an ABC Primetime program 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." What was consistently omitted in these public presentations were the political economic, organisational, and infrastructural back-end of the technological future. In 1991, one of Mark Weiser's PARC colleagues[2] 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." 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 1990's did raise the spectre of a surveillance dystopia, echoing almost precisely the concerns around smart technologies today. The *San Jose Mercury News* (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* (1992) mused, might be an "Orwellian Dream Come True". Similar comparisons and anxieties continue to accompany promises of IoT and smart machines, but struggle to unsettle the dominant position of the utopian projection. Twenty years on, 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 was a 2014 *Wired* article—with a "#Ethics" hashtag to boot—confidently exclaiming that "sharing your most personal asset [data] may be the best decision of your life." (Seidenberg, 2014)

The historical irony is that the success of smart technologies over the 2010's has been based on the turn towards surveillance as the true 'user' of such ubiquitous machines.

[2] Handwriting suggests this may have been Marvin Theimer, the PARC scientist who collaborated with Weiser in numerous ubicomp projects.

Ubicomp's utopia invites the assumption that the technology will be optimised to the *user*'s needs and wants, a user seemingly unfettered by societal and institutional constraints. In contrast, the development of smart technologies in the intervening decades has been optimised to capital's needs and wants *about* the customer, the subject, the data point. Through the burst of the dot-com bubble and the reorganisation of what would become the platform economy, and subsequently the rapid popularisation of big data analytics, 'personalisation' in computing has increasingly come to involve not the personal user, but personal data whose primary 'users' are the advertisers and data brokers. Mark Andrejevic (2005, p. 110) describes how ubicomp and proximate research was, at one point, consuming most of Intel's R&D budget. 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 behaviour, selling on predictions, and ultimately constraining and foreclosing the human will (e.g. Srnicek, 2017; Zuboff, 2019; Cheney-Lippold, 2017).

Futures Lost

The recycling of technofutures, such as between ubicomp of the 1990's and smart technology of the 2010's, confines 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 blindspots around asymmetric power relations in the development of new media technologies. These stagnant imaginations of the social are not simply byproducts of the technical capabilities of new machines; rather, both are dependent on the circulation of ambiguous and deferred futures as shared points

of reference. One corollary is that the stagnant imaginations of the social pertain not only to *what* is assumed around the user, but *how* such ideas are produced and circulated. Alongside specific images like the 'smart' office or the robot-assisted housewife, there emerge questions of who is imagining for whom and by what means. It is a reminder that the persistent blindspots in imaginations of technological neutrality, or privacy as an afterthought, have a long cultural tail—and that the very structure of how these technological futures are produced and repeated have an impact on the life-cycle of accompanying social imaginaries as well (also see Sadowski, 2020, Chapter 8).

The conservatism of technofutures in ubicomp and smart machines cannot be reduced to the ability or inability to deliver a particular technical function. Rather, it lies in the narrow constraining of the kinds of relationships between human subjects and machines—and, more importantly, between the 'user' and the institutions behind the machines—that are popularised as aspirational norms. For Weiser, ubicomp was an effort to expand the technological imagination beyond what he saw as the tyranny of the 'personal': the personal computer, the laptop, the personal assistant, with all the limitations of in-your-face machinery that they represented for him. Yet the actualisation of such visions in service of surveillance capitalism highlights another important lesson. The fetishisation of the 'user' as the locus through which technologies are promised, tested, and judged consistently downplays the political economic, institutional, and historical interests and biases that feed into these technological futures (also see Hu, 2015, Chapter 2). As this asymmetric visibility in the imagination is repeated across generations, the 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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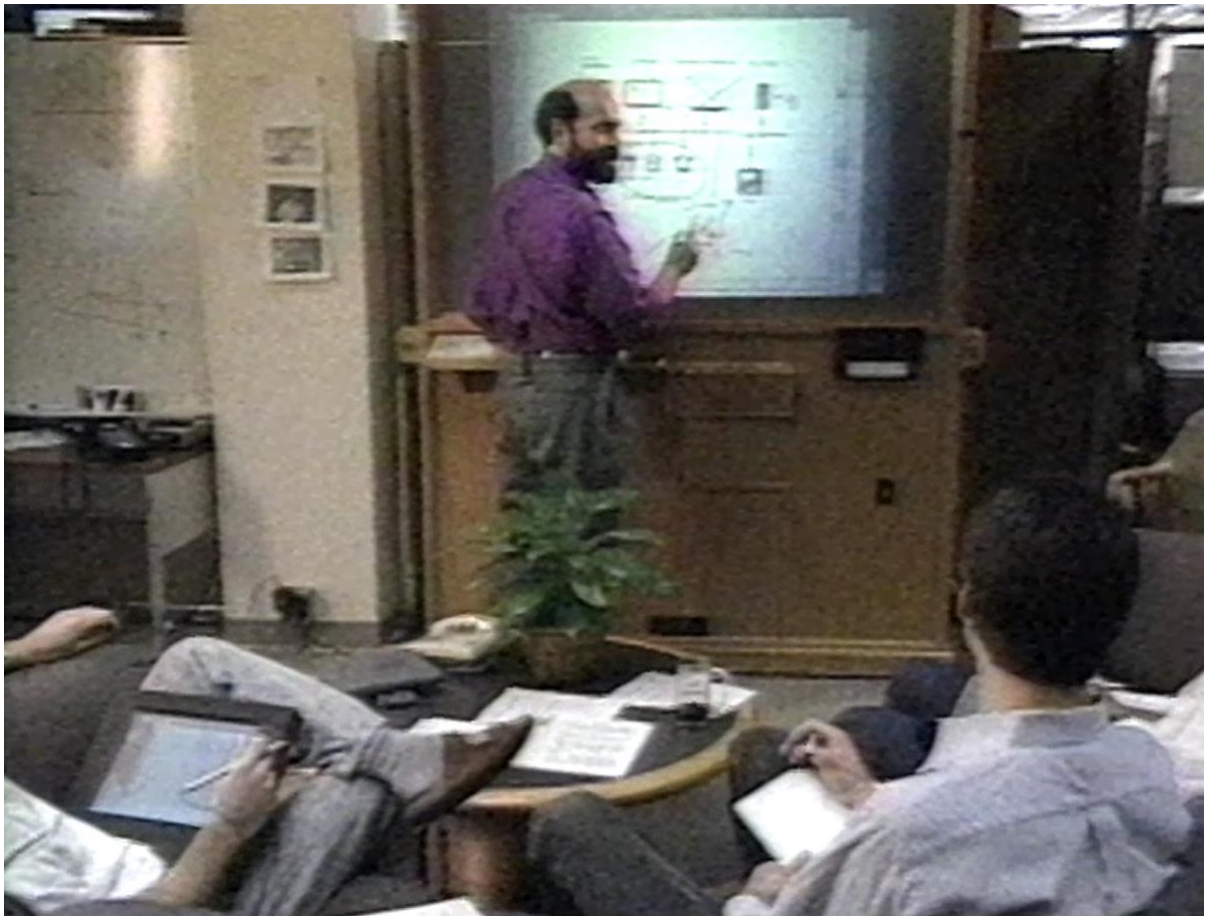
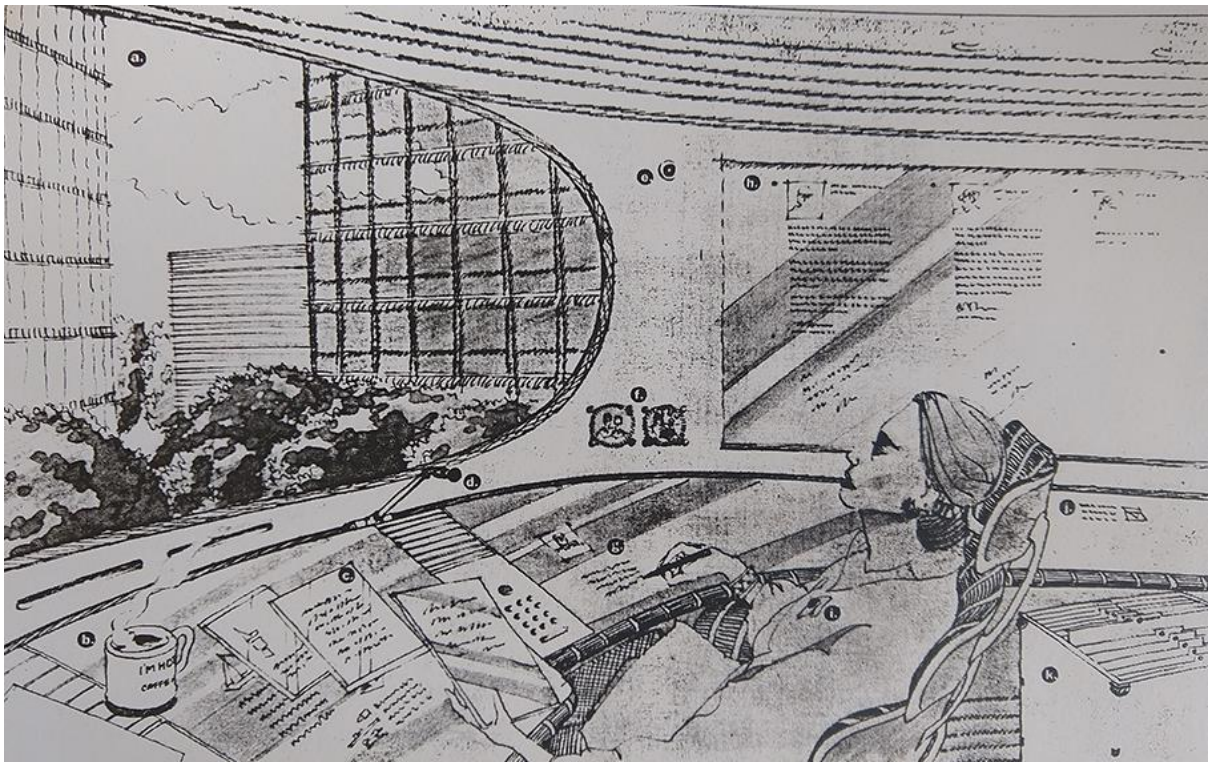
Appendix

Fig. 1



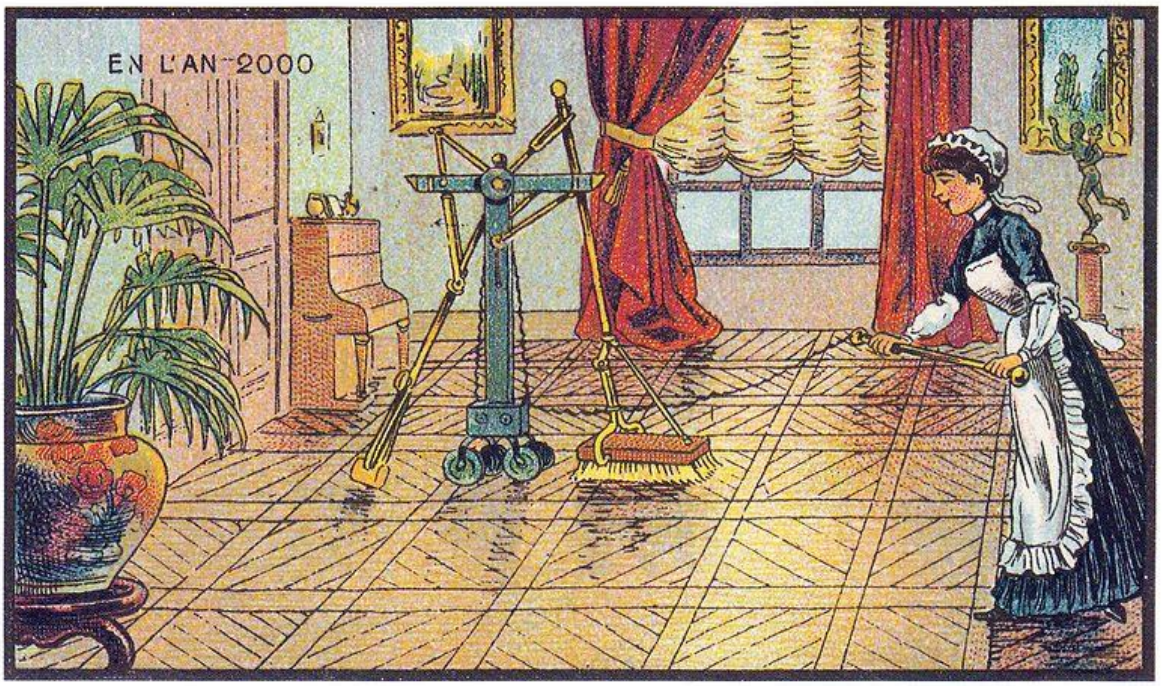
Source: Author's screenshot from a VHS recording of *Innovation* (PBS, 1997) from the Mark Weiser Archives, taken with permission at Stanford Libraries Special Collections.

Fig.2



Source: Author's photograph of *Palo Alto Weekly* article (1992) from the Mark Weiser Archives, taken with permission at Stanford Libraries Special Collections.

Fig.3



Electric Scrubbing

Source: Public Domain.