

A bias against the present: Recurring sociotechnical oversights in HCI’s cyclical visions of the future

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Abstract

This talk explores the process of “visioning” in HCI as a form of highly rewarded intellectual contribution, and how sociotechnical oversights embedded in visions of the future recur across eras of HCI research. We argue that this reflects research incentives that reward imagining possible futures over dealing with mundane, present-day usability issues. We point to the tension between this observation and the fact that HCI should be well-positioned to engage with practical problems because of the research community’s high concentration of researchers producing descriptive and critical accounts of real-world technology use.

1 Introduction: A cycle of visions

Human-Computer Interaction (HCI) is an interdisciplinary research area which first emerged as a subdiscipline of academic computer science in the 1980s. In HCI, research paradigm-setting [20] often takes place through the articulation of a “vision” of a new way in which humans might interact with computers in a “proximate” future [9]. Over time, the field has accumulated a large number of such visions (e.g., Direct Manipulation Interfaces [14], Tangible User Interfaces [16], Ubiquitous Computing [32], Crowdsourcing [18], Artistic Support Tools [21], Olfactory Interfaces [3], to name a few). Successful visions become more concrete over time as funders provide resources, researchers collaboratively expand and define the bounds of the vision, the community develops a body of work that can be referenced and built upon, and eventually academic stakeholders create infrastructures like conferences, subcommittees, and journals that can carry on refining and developing these ideas over years or decades.

This pattern is not unique to HCI research [23], but HCI is remarkable for the quantity and diversity of visions which it generates, appropriates, and accommodates. Since HCI research is often concerned with exploring *possible* modes of interaction, it often attempts to be pre-figurative—to develop prototypes or “promissory objects” [15] that reveal the broad strokes of a possible future, and, by doing so, make that future more likely. Despite sharing common visions, many areas of HCI research suffer from relatively fragmented technical bases; works are often grouped together by conceptual basis or context of use, rather than a shared implementation or algorithmic technique. For example, an HCI researcher working on a new virtual reality (VR) interaction technique may be less excited about their specific prototype’s technical contribution or application to existing head mounted display devices, compared to how it might expand the field’s overall vision of what is *possible* in VR. A new or improved vision is a type of research deliverable, one that can yield significant influence and prestige, which motivates researchers to develop an ever-growing procession of new

visions in the pursuit of recognition, differentiation, and tenure. (For instance, the “visions” track is considered a highlight of the ACM UIST conference as senior academics set forth and reflect on their own research agendas.)

This talk explores the ways that the breadth and frequency of vision generation in HCI contribute to a preoccupation with the near future rather than the technological present. As HCI researchers focus on expanding the bounds of their visions and are incentivized to prioritize optimistic “greenfield” innovation, developing new prototypes and use cases takes priority over improving currently-existing instantiations of these visions. Mundane problems grounded in sociotechnical realities are considered uninteresting and unlikely candidates for rapid progress. The key insight we wish to advance is that, though HCI is a particularly self-reflexive field, this self-awareness and self-criticism has not meaningfully shifted the dynamics of how technological visions and novel technologies are introduced, leaving confrontation with mundane reality to be handled later in the process—often by those outside the research community, like IT workers—when problems are already firmly entrenched.

We explore the visioning process in HCI through two case studies. To provide a concrete example of how visions from academic and industry research can come to influence real-world technology use, we first summarize Ubiquitous Computing (or UbiComp), one of the most successful, well-documented, and thoroughly analyzed visions in HCI’s sphere of influence. Then, we draw parallels between persistent, incentive-driven technical issues in the “messy” present of real-world UbiComp (e.g., breakdown during mundane tasks like connecting to projectors) and parallel problems identified in a developing research area centered around increasing the malleability of user-facing software tools and abstractions (variously referred to as “dynamic abstractions” [29] or “malleable software” [22]). We conclude with possible research directions that may shed light on why we continue to see, and lack the tools to resolve, these recurring sociotechnical contradictions embedded in HCI research visions.

2 Visions make contact with reality

By exploring examples of the visioning process in HCI, we can examine both how visions are introduced and developed and how they impact the world. As a first question, one might wonder whether the visioning and prototyping labour of HCI researchers significantly influences our actual technological environments at all. Researchers have periodically expressed skepticism; for example, the early innovator Bill Buxton voiced this concern in 2001 when, summing up research at CHI since its inception in 1982, he wrote, “...despite a huge body of literature being generated in the intervening years, none of it has had any impact on the design of personal computers, relative to the impact of the [Xerox] Star [4].” However, six

years later, Buxton’s pessimism was undercut with the unveiling of the iPhone’s multitouch capabilities—his research conducted in the mid-1980s (and parallel research by Bell Labs) had finally been shipped to the mass market after a lag of several decades.

In fact, over a long enough timescale [5], many of the interaction paradigms explored by HCI do eventually find widespread adoption. It is sometimes difficult to trace a clean causal thread between an academic research vision and the products or systems that follow. Reinvention and parallel discovery are common, and computer science in particular has a culture of convenient forgetting [8], where links to past research are productively (though not necessarily consciously) ignored or elided. However, like many other STEM fields, partnerships with industry provide resources (and thus set priorities) for HCI research, and in cases where researchers partner directly with industry to bring their vision into reality, a causal link can be more easily identified.

Compelling visions are a way of making disparate areas of research legible and attractive to corporate funders [26] as well as academic gatekeepers such as tenure and promotion committees. This gives HCI researchers incentive to engage in development of new visions, or to frame their research as making progress towards an existing but as-yet unrealized vision. Doing so can help give them access to industrial partners with significant capital, ability to set development priorities, and power to subsidize new technology use to encourage it to “take off” (e.g., ridesharing, LLMs).

The initial vision for Ubiquitous Computing was formulated by the academic Mark Weiser and others at XEROX PARC in the late 1980s - an alternative to desktop computing, it envisioned a world where distributed computers disappeared into the background and became part of the fabric of everyday life [32]. Rawn’s recent article in the *Annals of the History of Computing* [26] provides a detailed account of the visioning process that led to Ubicomp, and outlines the three key technical themes (pervasiveness, portability and interoperability) that were used to connect varied lines of research at PARC around this common vision. From this initial vision, Ubicomp grew into a thriving research community (Ubicomp 2025 being the 27th entry in the field’s namesake international conference series) and an area of strategic investment for many other multinational corporations over the years (Intel, Microsoft, Google, etc.).

We live in a world where the Ubicomp vision has come true, and we have for some time [1]. It is no longer surprising that large numbers of everyday objects contain embedded, networked electronic devices, or that files sync “seamlessly” between a user’s multiple devices via tech companies’ cloud servers. But in Ubicomp’s existing, “messy” [9] form, there are key ways that this vision differs from the initial dream that seem relatively resistant to solutions, given researchers’ current methods of knowledge production and contingent ability to influence the technological status quo.

One persistent and vexing issue is that while during typical use, computing technology does successfully “fade into the background” [32], occasional but not uncommon scenarios still result in *breakdown* [33], which shatters this illusion and requires difficult debugging work from users to resolve. A common scenario in which this arises is attempting to connect to new computing resources in the environment—such as connecting a laptop to an unfamiliar projector. In cases such as this, a user often needs to quickly develop a mental model of the new projector, and what inputs and commands

it expects, as well as remembering the rarely encountered details of their own personal computer’s display settings.

Developing better device-to-device communication protocols and interaction models that would reduce much of this work is technically feasible, but is a difficult sociotechnical problem, requiring buy-in from and coordination between a large number of different vendors and stakeholders.

From the companies’ perspective, improvements in user experience might be desirable, but it does not have the potential for transformatively high returns that other technology investments (currently, AI initiatives) seem to promise; and in general, the technology industry consistently devalues labour geared towards maintenance or improvement of existing products and ecosystems. Seamless interoperability with a competitors’ product may even be undesirable from a market standpoint*. And from the researcher’s perspective, this seems like a difficult problem to tackle without access to the black-box implementations of the different systems, as well as requiring significant implementation work that may be beyond the resources of an academic lab. It is easier and has a greater potential for impact and accolades to work on problems that are well matched to their available resources (such as visioning and prototyping).

Though interoperability was a key plank of Ubicomp’s vision from the very beginning, the related sociotechnical issues were still presented as an emerging challenge much later. A decade after the initial presentation of the Ubicomp vision, Edwards and Grinter [10] identified interoperability between devices from different vendors as a problem that could lead to “incompatibility and isolated islands of functionality” if not addressed. And 25 years later, this type of quotidian usability problem persists.

3 Dreaming of the future, but ignoring the past?

In the meantime, HCI researchers have developed a stream of new visions. Priorities change in reaction to emerging technologies, sociocultural anxieties, the funding environment, and a variety of other factors. Visions that originate outside the field can be re-contextualized and repurposed, and old visions can lie dormant waiting for their day in the sun.

One “cluster” of visions that has attracted much excitement in recent years calls for making user-facing abstractions and interfaces more “malleable” or “dynamic”. This can range from offering users multiple levels of abstraction when browsing data [30] to letting them author widgets and simulations dynamically [31] to modifying software incrementally to make it better align with their needs [6]. The shared promise of these visions is to give the end user control over interactions with their software’s abstractions, so they can choose the most cognitively appropriate abstraction for a given task. This cluster can be thought of as a descendant or reconfiguration of many longstanding research paradigms (end user programming [19], visual computing [28], etc.). However, the present moment has seen a critical mass of researchers gather around the topic.

Recent advances in AI models that can write code and generate user interfaces have made malleability both easier to achieve and

*Consider that cross-device interaction works most smoothly when a user stays within the closed ecosystem of a single tech company (such as Mac computers’ interoperating with iOS devices and wearables such as Apple Watches and AirPods) and breaks down or becomes spotty the more different systems and vendors are involved.

more interesting for many researchers, as the concept of dynamic abstraction provides a useful lens for analyzing large swathes of Human-AI interaction research. This has resulted in the formation of a budding community around the label of “dynamic abstractions” through conference meetups and a workshop, and an ongoing reading group. In parallel, independent research lab Ink & Switch released an essay [22] outlining a similar vision, drawn from their experience building prototype systems that embody different aspects of malleability, and longstanding initiatives such as Dynamicland continue to explore new aspects of this space [2, 24]. Though, unlike in the case of Ubicomp, there is no single industry research lab that can claim to have originated the vision, one can draw direct links between core pieces of research and various industrial actors and private research organizations, who find the vision complementary to the development of their products and initiatives.

The future where these visions of malleable abstractions come into widespread use would be an exciting and promising one. However, looming in the distance are many of the same sociotechnical difficulties that have plagued HCI's more mature visions of the future. Many works emphasize the underlying difficulty of producing truly dynamic and malleable software in an overall ecosystem where infrastructure such as operating systems, platforms, and app stores is not designed with malleability in mind, and where malleability may go against the interests of those who control the infrastructure [22, 24]. The technical HCI researcher's toolbox of creating prototype systems can demonstrate possible alternatives to closed ecosystems, but the infrastructure problem [11] remains largely intractable for individual researchers if the goal is to fundamentally change the modal experience of interacting with software.

Though many works explore dynamic abstractions at the interface or interaction level, within a single application, one could argue that without the freedom to fully modify the interface, to transfer data between applications, or compose tools, the power still resides with the creator of the software and the owners of the infrastructure, in opposition to the spirit of the vision [21]. Without addressing how end users might break free of these constraints (through either technical or social means), dynamic abstractions and malleable software may end up treading the same path as Ubicomp—with a real-world instantiation close to but not quite the same as what the vision initially promised, seemingly stuck without a clear path to resolving stubborn sociotechnical challenges.

4 A disconnect underlying the visioning cycle

The fact that new visions run into the same issues as old ones could be surprising, since HCI has such a rich conceptual apparatus for analyzing, describing, and even predicting sociotechnical problems and how they impact technological development. Much reflective work has focused on Ubicomp, such as Dourish and Bell's *Mess and Mythology in Ubiquitous Computing* [9], which identified key differences between the vision and reality of Ubicomp, and in so doing shifted the theoretical foundations of HCI towards critical and self-reflexive approaches. As part of HCI's reflexive turn, the field has developed a large number of theoretical lenses: *Seamful Design* [7] and the infrastructure problem [11] are especially relevant to the issues sketched above.

At the same time, decreasing friction and contestation [15] is often a necessary part of the early stages of a design process, as seen in the standard practice of banning criticism of ideas during a brainstorming session. Perspectives that are too critical or “too political,” such as the intractability of sociotechnical issues, may be kept out of visioning conversations [15]—not necessarily out of malice, but because those perspectives may not be perceived as helpful for advancing a new vision or “predict[ing] the future [by] invent[ing] it” as in the XEROX PARC slogan [17].

This points to a possible tension between the incentives of HCI researchers who are developing technically novel systems and prototypes, and those who are researching the sociotechnical implications of presently existing technology.

Technology developers are rewarded for their novel technological visions and creating prototypes that advance and elaborate upon these visions. Conveniently, the articulation of a novel research vision (or a new spin on an existing research vision) fits neatly with the “job talk” format that is often required for acquiring stable research positions in both academia and industry. Often, building robust working systems that could plausibly form the basis of new infrastructure is less rewarded than creation of throwaway prototypes that expand the bounds of the vision—which handily allows the research idea to always exist as a prototype rather than a system in actual use, allowing the cycle of vision elaboration and expansion to continue more or less in perpetuity.

Descriptive and qualitative researchers, on the other hand, are rewarded for producing insightful descriptions of technology use, articulating the needs and experiences of technology users and developing new lenses to understand relationships between humans and computers. But there is limited incentive for researchers developing exploratory technologies to respond to insights that these researchers surface. Despite a sophisticated set of research tools that should help bridge this gap (for example, techniques from participatory design [25] and value-sensitive design [12]), we would argue that it is still the exception rather than the rule that this intra-community cross-pollination meaningfully alters the course of a technological vision.

One productive avenue for investigating this issue could be to double down on self-reflection, specifically focused on developing accounts of how incentives shape HCI researchers' process of problem selection, to explain and propose remedies for the disconnect between insights from critical research and the path of technical research visions (along the lines of similar investigations of other fields, such as Jeff Schmidt's reflections on the funding infrastructure in physics research [27] or Lilly Irani's investigation of human-centered design through an ethnography of a product design studio [15]). However, turning a critical lens on ones' own research community in this way is a potentially fraught matter, which may make this a challenging endeavour.

We believe that the cyclical nature of the visioning process in HCI research is an interesting field of investigation to identify areas of undone science [13]. There is much to be learned through the comparative analysis of research agendas and trajectories associated with different visions, to better understand field-wide patterns of research labour in HCI, and identify areas which may offer paths out of the current cycle.

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