

CHAPTER 2

The Backdrop to HCI Theory

“There is nothing so practical as a good theory.” (Kurt Levin, 1951)

2.1 TRANSFORMING SOCIETY

The arrival and rapid pace of technological developments in the last few years (e.g., the internet, wireless technologies, mobile phones, pervasive technologies, GPS, multi-touch displays) has led to an escalation of new opportunities for augmenting, extending and supporting a range of user experiences, interactions and communications. These include designing experiences for all manner of people (and not just *users*) in all manner of settings doing all manner of things. The home, the crèche, the outdoors, public places and even the human body are now being experimented with as potential places to embed computational devices. A wide-reaching range of human activities is now being analyzed and an equally eye-popping set of innovative technologies proposed to support them, to the extent of invading previously private aspects of our lives (e.g., domestic life and personal hygiene). A consequence is that “the interface” is no longer about the WIMP or the GUI, but has become ubiquitous, being viewed as invisible, natural and everywhere. Computer-based interactions can take place through many kinds of surfaces and in many different places. As such, many different ways of interacting with computationally based systems are now possible, ranging from that which we are conscious of controlling (e.g., using a keyboard with a computer monitor) to that which we may be unaware of how we manage it (e.g., our brain waves moving cursors on screens and moving sensor-controlled tangibles).

Simply, the world has become suffused with technologies that have profoundly changed how we live. Computers have intruded in our lives as well as disappeared into the world around us; they now monitor as well as guide us; and worrying for some, they have even begun coercing us to change our behavior. They increasingly have become part of our everyday environment, in public spaces such as airports, garages and shopping malls, as well as in the private spaces of our homes.

Clark (2004) proposed the *extended mind theory*, where our minds have now extended into the world to the point that technology has now become part of us. For example, it is now common place for people to use online calendars to remind themselves to send a birthday card to a friend or Google information on their smart phones during ongoing conversations at dinner parties to name an actor or produce a factoid that may be on the tip of everyone’s tongue but unable to be mentally recalled by anyone. On first owning an iPhone or an iPad, people noticed how it started taking over more and more of their brain functions, increasingly replacing and augmenting parts of their memory, such as storing addresses and numbers that once would have required cognitive effort to recall. In-car GPS

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systems have also replaced map reading skills; many drivers now follow instructions reducing the cognitive effort that was needed to work out the best route. For an increasingly number of them, it is becoming unimaginable not to be aided in this way (Chalmers, 2008). They are no longer cognitive amplifiers or aids; they have become an integral part of us, how we interact with the environment and each other.

At the same time affordable computing devices, especially cell phones, are becoming more accessible across the globe. More people than ever are now using a cell phone or other computing device, be they a retiree in New Zealand, a schoolchild in Africa or a farmer in Outer Mongolia. The way children learn is also changing as more and more technologies are assimilated into their lives. For example, how it happens (e.g., taking part in a discussion with people from all over the world) and when it happens (e.g., listening to a podcast about pollution while cycling home) is changing. The number of elderly people is increasing as a proportion of the total population. Those growing old in the next ten years will have become accustomed to using computers and cell phones in their work and leisure. Hence, the need to design computer applications for old people who have not used email or the internet will no longer be a major concern but designing social network sites, creative tools, etc., for healthy, active 70-, 80-year olds and beyond, will.

Technological developments, therefore, are not only altering the way we grow up and grow old, but pervading almost every aspect of our daily lives, from how we shop to how we look after ourselves, increasing our reliance on them. We are spending more time, and devoting more effort to being in touch with each other than ever before. Our unbridled desire to keep in touch is equaled by our desire to capture more information about our lives and our doings than ever before. What it means to record, why we record and what we do with the collected materials is also changing. This is happening not just at a personal level, but also at the level of government, institutions and agencies.

For the HCI researcher, such developments pose new moral design questions: should they continue to design ever more digital prosthetic aids for people, so they no longer have to think or learn how to accomplish a task by themselves? Or, should a line be drawn, where the designer says no to the seemingly latest preposterous idea, such as a computer agent taking over major policy-making decisions, or at the other end of the spectrum, reminding someone when to go to the toilet or clean their teeth? Is it desirable and socially acceptable to continuously suggest, create and swamp human life with every conceivable technology augmentation? Moreover, how can theories about what it means to be human and technology augmented help the researcher address these concerns?

2.2 HCI'S GROWING PAINS

How are researchers in HCI and those who practice "UX design" keeping up with and responding to the technological changes? Should they continue to do what they know best, applying their armory of methods in order to improve the interfaces for existing products, or should they divert their time to designing and creating new technological products, now that it is easier to make prototypes and much more affordable to do so? It seems the HCI community is increasingly doing both, plying their trade in inventive and evolutionary ways. In order to keep abreast and be valued, HCI research and design

has had to change: from what it examines, the lenses it uses and what it had to offer. It no longer confines itself to being about “user-centered design,” but has set its sights on pastures new, embracing much broader and far-reaching agendas. Following the dot.com bubble in the mid-late 1990s and the social media revolution in the early 2000s, what the field has attempted to improve, design and facilitate has snowballed. HCI research has changed irrevocably. The list of topics is diverse, from emotional, eco-friendly, and embodied experiences to context, constructivism and culture.

Part of the new order came about as a reaction to what HCI researchers saw happening in the world, especially the ways ubiquitous technologies proliferated and so rapidly transformed how people lived their lives (Bell and Dourish, 2007). Another reason was the many new opportunities offered to HCI researchers to not always be one step behind reworking poorly designed interfaces, but to be ahead of the game, becoming inventors, tinkerers and designers, themselves, creating new apps, services, interventions, prototypes and devices. The technological developments, coupled with many innovative HCI up-to-date curricula, has meant that a new generation of researchers have come to the forefront, with a much wider skill set than previous ones, no longer dependent on others doing the building and the implementing. They are joining forces with the Maker's Movement; where innovative interfaces and user experiences are created and experimented with in-the-wild, opening up new avenues of research.

Much has been gained from this rapid expansion. However, the downside has been growing pains, in terms of not being able to establish a clearly defined identity (Grudin, 2006). It became much more difficult to explain, justify or account for the funding, the findings and the acceptability of the research. The trivial and the serious began to sit side-by-side where anything became potentially a topic for HCI (Rogers, 2009). When asked what we do for a living, many of us began to find it increasingly difficult to explain in a sentence, in the way HCI researchers used to do 10 years ago, e.g., “designing computers to be easy to use.” Instead, there is much fumbling with adjectives and fuzzy slogans, such as “designing engaging computer interfaces” and “what it means to be human in a world full of computers.” We often find ourselves talking about specific projects, such as “I am concerned with the privacy issues surrounding how web, mobile and sensor-based technologies track your every move or click” and resort to using everyday examples such as the iPhone by way of illustration.

While “living without parental controls” (Grudin, 2007) can be liberating in a rapidly transforming society, the questions HCI researchers ask, the purpose of their endeavors and the motivation behind them still need scrutiny, debate and reflection, especially if their outputs are to be of relevance and value to society. Part of this entails setting new agendas, determining what to throw out and what new topics and concerns to focus on. Even its very core — prescribing usability (i.e., how to design easy-to-use tools) — needs rethinking given that *using* technology is becoming second nature in its various manifestations to many people. The classic interface horror stories, such as the flashing VCR, have been superseded by more pressing matters that face society in the 21st century, such as how pervasive technologies are intruding and extending our physical bodies, cognitive minds and social lives. What does it mean to have 500+ friends online but not a best friend to hang out

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with everyday after school and share deep secrets with? What does it mean to know how many calories someone has burned, hours slept or energy consumed but to not know how to cook, sleep properly, or be able to switch a light on or off manually? These are the concerns that the HCI community is beginning to wrestle with, explicating what it means to be human in an age of ubiquitous computing ([Harper et al., 2008](#)).

2.3 ADOLESCENT HCI

In an attempt to keep up with and address the new challenges, significant strides have been made in academia and industry, alike, to extend HCI, by developing a wider set of methodologies and practices. Innovative design methods, unheard of in the 1980s, have been imported and adapted from far afield to study and investigate what people did in diverse settings. Ethnography, informant design, cultural probes, technology probes and scenario-based design are examples of these. Alternative ways of conceptualizing the field have also emerged. For example, usability has been re-operationalized, in terms of a range of user experience goals (e.g., aesthetically pleasing, motivating) in addition to the traditional set of efficiency goals. The concept of funology also came to the forefront, where it became widely acceptable to study and design for user experiences that were to do with enjoyment, aesthetics and the experience of use ([Blythe et al., 2008](#); [Hassenzahl, 2001](#)).

The desktop paradigm has been largely replaced by a new way of thinking about technology as being everywhere, invisible and embedded in the environment. New phrases were coined to reflect this: ubiquitous computing, pervasive computing and the “Internet of Things.” The main thrust behind ubiquitous computing came from the late Mark Weiser ([1991](#)), whose vision was for computers to disappear into the environment in a way that we would no longer be aware of them and would use them without thinking about them. Similarly, a main idea behind pervasive computing was that people should be able to access and interact with information any place and any time using a seamless integration of technologies. The idea behind the *Internet of Things* ([Ashton, 2009](#)) was to view physical and digital “things” as having their own identities and physical attributes that are part of a dynamic global infrastructure which enables them to act, interact and communicate between themselves and the environment, triggering all manner of services and providing contextual information when assumed relevant or needed.

Commentators in HCI have also started critiquing the field of HCI from a historical perspective ([Bannon, 2011a,b](#); [Grudin, 2012](#); [Hurtienne, 2009](#)). The current era of HCI has been characterized as the third wave ([Bødker, 2006](#)) or third paradigm ([Harrison et al., 2007](#)). Both are assumed to have replaced the second and earlier first waves/paradigms. Bødker, for example, refers to the first wave of HCI as framing design for the user at a desktop primarily in an office setting; the second wave as a broadening of this to include group working, shaped by ideas about situated and social action together with Scandinavian approaches to participatory design, and the third wave as expanding further into quite new use contexts and application types, that emphasize non-work, non-spaces and non-purposeful engagements, and where notions of culture, emotion, reflexivity and multiple mediation have entered center stage.

Harrison et al. (2011, 2007) have been more forthright in their claims about the third paradigm, arguing that HCI is in a period of crisis and the cluster of alternative approaches currently being articulated and promoted in HCI, such as embodiment, situated construction of meaning, emotion, will become part of a successor science, with “substantially changed epistemological commitments” (p390). They argue that the field needs this kind of Kuhnian shift, making way for multiple analytic perspectives that can expound the experiential quality of interaction and how people make meaning of their contexts and situations when interacting with technologies in their everyday lives.

The idea that we are entering a third wave/paradigm of HCI has struck a chord with many and is becoming part of the HCI discourse (e.g., Taylor, 2011). While strictly not true — since there have not been any *profound* shifts in the ways described by Kuhn (1962) — this rhetoric can help the community to understand the *significant* changes in research direction that have occurred. However, others have argued that alluding to such dramatic paradigmatic shifts in HCI does not reflect what has happened, since Human Factors, Information Processing and other approaches continue to co-exist, serving different purposes in the field (Grudin, 2006). Hence, it is not a case of one wave of research replacing another, but more a question of seeing the evolution of HCI through different epochs that overlap, and in so doing, leading to different questions being asked, methods used and challenges addressed in society’s pursuit of ever more technological development (Bannon, 2011b).

Alongside these reflections about the field of HCI, have been debates about whether, how and what kinds of theory can be of value in contributing to the design of new technologies. On the one hand, are staunch advocates, arguing that a theoretical foundation is imperative for addressing the difficult design challenges ahead that face the HCI community (e.g., Barnard et al., 2000; Hollan et al., 2000; Kaptelinin, 1996; Sutcliffe, 2000) but that there is a worrying lack of it (Castell, 2002) echoing earlier concerns about the field that “there is only an HCI theory vacuum” (Long, 1991). On the other hand, some have argue that theory has never been useful for the practical concerns of HCI and that it should be abandoned in favor of continuing to develop more empirically based methods to deal with the uncertain demands of designing quite different user experiences using innovative technologies (e.g., Landauer, 1991). After all, many popular methods, innovative interfaces and design solutions have been developed without a whisker of a theory in sight.

Part of this dilemma has been the acknowledgement that there has been a paucity of adequate theories that can be directly applicable to HCI concerns. It is increasingly acknowledged that theories about human-computer interaction, that were derived from lab-based research often do not map onto the messy human-computer interactions in the real world. People are much more unpredictable — for example, they get distracted and are constantly interrupted or interrupt their own activities by talking to others, taking breaks, starting new activities, resuming others, and so on. Likewise, it has proven difficult to say with any confidence the extent to which a system or particular interface function can be mapped back to a theory. Typically, theories end up as high-level design implications, guidelines or principles in interaction design. The question this raises, therefore, is whether such generalizations — which claim to be based on particular theories — are accurate derivations from

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those theories. As [Kraut \(2003\)](#) notes, if a system that is designed based on these theories is shown to improve a particular behavior, to what extent can it be said to be due to a specific phenomena identified by a theory? For example, how can we be sure that a computer-based brainstorming tool is responsible for increasing more equitable participation in a meeting because it has reduced social loafing or production blocking? It could be equally due to other factors, such as the time of day, the make-up of the group and so on. It is not surprising, therefore, to often see mixed results, in which sometimes a brainstorming tool has been found to improve a behavior and other times not.

2.4 GROWN-UP HCI: REFRAMING THEORY

Importing and adapting alternative theories from other areas to address new concerns in HCI continues to be a staple of HCI research. Examples include embodied interaction ([Dourish, 2001](#); [Hurtienne, 2009](#)), ecological rationality ([Todd et al., 2011](#)) and proxemics ([Ballendat et al., 2010](#)). Recently, there have been attempts to develop new HCI theories that are based on the body of knowledge accumulating in HCI, as opposed to importing and adapting theories from other disciplines. For example, [Rogers \(2011\)](#) proposes developing new forms of “wild” theory that are based on the findings emerging from recent in-the-wild studies rather than imported theories that are largely derived from lab-based studies. Part of the appeal is their ability to account for technology-augmented behaviors and to inform new interventions to change behaviors that people care about — compared with the scientific theories that were intended to test predictions, and to make generalizations about human performance under controlled conditions. The ones likely to be successful are those that can address a range of interdependencies between design, technology and behavior. But they will need to be framed in the messy world, rather than an idealized world.

In the next chapter, I discuss further the different roles and contributions theory has made to HCI.