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Yvonne Rogers

Classical, Modern, and Contemporary

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ABSTRACT
Theory is the bedrock of many sciences, providing a rigorous method to advance knowledge, through testing and falsifying hypotheses about observable phenomena. To begin with, the nascent field of HCI followed the scientific method borrowing theories from cognitive science to test theories about user performance at the interface. But HCI has emerged as an eclectic interdiscipline rather than a well-defined science. It now covers all aspects of human life, from birth to bereavement, through all manner of computing, from device ecologies to nano-technology. It comes as no surprise that the role of theory in HCI has also greatly expanded from the early days of scientific testing to include other functions such as describing, explaining, critiquing, and as the basis for generating new designs. The book charts the theoretical developments in HCI, both past and present, reflecting on how they have shaped the field. It explores both the rhetoric and the reality: how theories have been conceptualized, what was promised, how they have been used and which has made the most impact in the field — and the reasons for this. Finally, it looks to the future and asks whether theory will continue to have a role, and, if so, what this might be.

KEYWORDS
HC1 theory, frameworks, models, design implications, third-wave HCI
In memory of Mike
# Contents

Preface ................................................................ xi
Acknowledgments ....................................................... xiii
Figure Credits ........................................................ xv

1 Introduction .............................................................. 1
  1.1 Burgeoning HCI ....................................................... 1
  1.2 Conceptualizing HCI: From Paradigms to Frameworks .............. 4
  1.3 Aims of the Book ....................................................... 6
  1.4 Parallels with Art History ........................................... 7

2 The Backdrop to HCI Theory .............................................. 9
  2.1 Transforming Society .................................................... 9
  2.2 HCI's Growing Pains .................................................. 10
  2.3 Adolescent HCI ....................................................... 12
  2.4 Grown-up HCI: Reframing Theory .................................. 14

3 The Role and Contribution of Theory in HCI .............................. 15
  3.1 Introduction .......................................................... 15
  3.2 Importing Theory ..................................................... 15
  3.3 Different Roles and Expectations ...................................... 16
  3.4 A Taxonomy of HCI Theory: Classical, Modern and Contemporary .... 18

4 Classical Theories .......................................................... 21
  4.1 Body of Knowledge .................................................... 21
  4.2 Applying Basic Research ............................................. 22
  4.3 Cognitive Modeling ................................................... 23

5 Modern Theories .......................................................... 31
  5.1 External Cognition ..................................................... 32
    5.1.1 Cognitive Dimensions ............................................. 35
Human-computer interaction (HCI) has grown enormously in its relatively short history since becoming a field in its own right in the early 1980s. As per Shneiderman (2011, p10), "we’ve grown from a small rebellious group of researchers who struggled to gain recognition as they broke disciplinary boundaries to a broad influential community with potent impact on the daily lives of every human." In an attempt to keep up with unprecedented technological developments, HCI has emerged as an eclectic interdiscipline rather than a well-defined science. While it was concerned at its inception primarily with the interface between a user and a computer it now covers all aspects of human life, from birth to bereavement, through all manner of computing, from device ecologies to nano-technology.

One reason for HCI’s remarkable expansion is its unremitting desire to address whatever seems fit; from critiquing domestic life to building brain-computer interfaces. No longer only about designing computers that are easy to use, learn and remember, it considers itself capable of commenting and capitalizing on technologies in far-reaching ways, from helping save the planet to encouraging world peace. Several HCI researchers have begun to reflect on the enormity of the burgeoning field: from what is studied, designed and evaluated. Likewise, I consider it timely to take stock and think both about our achievements and our future. Whereas Grudin (2012) thoughtfully charted HCI’s checkered history, populated by the people who made it, the landmark research that stands out and the legacy technologies and interfaces that changed our lives, the focus of this book is the theoretical developments in HCI, both past and present, examining how they have shaped the field. In particular, I explore both the rhetoric and the reality: how theories have been conceptualized, what was promised, how they have been used and which has made the most impact in the field — and the reasons for this. I also look to the future and ask whether theory will continue to play a prominent role in research and, if so, what this might be, given the ever-changing challenges we face.

Ten years ago the “user experience” (UX) was all the rage. There was much excitement about what it meant in terms of engagement, enjoyment, fun and even the “felt” experience (Rogers et al., 2011). The UX rapidly became popularized in practice, replacing the “user-friendly” slogan of old school HCI. It was the essence of what people came into contact with, and referred to any artifact, including “newspapers, ketchup bottles, reclining armchairs, cardigans, sweaters” (Garrett, 2010, p10). This widening of HCI has given researchers the license to explore and reflect upon every nook and cranny of life, and to experiment with all manner of technologies, conjuring up and writing about topics that would have been inconceivable just a few years before, such as digitally enabled sex toys (Bardzell and Bardzell, 2011).

Many others from all walks of academic life started to join the field, taking turns dismissing and rejecting the early vanguards of HCI, and suggesting alternative ways of conceptualizing users,
interactions and the user experience. Some argued for ousting old school HCI (N.B. The field is only about 30 years old) in favor of different paradigms, such as the third wave (Harrison et al., 2011, 2007). In the 2000s, interaction design became the new HCI (Löwgren and Stolterman, 2004; Preece et al., 2003).

But what do such rapid and radical changes mean for a nascent field, such as HCI? The paint has barely dried for one theory before a new coat is applied. It makes it difficult for anything to become established and widely used. Judging by the diversity of papers that are now accepted at the annual flagship U.S. conference, CHI, and its galaxy of sister venues (e.g., ItalCHI, NordCHI, SouthCHI, OzCHI), there is no longer a coherent set of aims or goals, or accepted classification of contributing disciplines. It seems anything goes and anyone can join in. The early mantra of HCI “know your user” has in a few years all but been superseded by the socially aware slogan “make an impact.” Instead of striving to fix interfaces so they are easy and obvious how to use, the community is looking at how it can transform the world to be a better place.

Such flux would seem alien to established disciplines, such as physics and chemistry. Breaking the mold requires a paradigm shift with a good deal of momentum. Within HCI, however, deep roots have not had time to take a hold and so it is easier to go with the flow. The field is a follower. Today, it is very much in tune with contemporary societal concerns. Its motivation has shifted from efficiency and profit towards altruism and alleviating fear — there is a strong desire and belief that we can help improve the lives of those who are impoverished or disadvantaged through designing innovative technology solutions.

Given these new expectations, how does a researcher, designer or student of HCI know where to begin to look for inspiration? The purpose of this book is to help them on their journey by charting and critiquing the various theoretical developments throughout the history of HCI. It examines the utility of the conceptual tools and analytic methods that have been imported, adapted and developed, and how they have grounded concerns, problems and new opportunities through their theoretical framing. Specifically, it asks how applicable they are in terms of how can they help researchers and designers scope, manage and make sense of the space they choose to look at, work in or analyze.

A central theme is how and why HCI theory keeps changing its spots. Part of the reason is a perceived need to continuously invent new theories in order to keep up with the changes afoot that beset HCI practice. A recurring question this raises is the extent to which new insights and applicable tools can be delivered that others, besides those producing them, can and will use. The book discusses what this medley of theories might be and ends by speculating how new approaches are faring against the changing world of research, design and practice.

Yvonne Rogers
May 2012
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Figure Credits


**Figure 4.2** Olson, J.S. and Olson, G.M. 1991. The growth of cognitive modeling in human-computer interaction since GOMS. *Human Computer Interaction*, 5, 221-265. Copyright ©1991, Taylor and Francis. Used with permission.

**Figure 6.1** Harper, R., Rodden, T., Rogers, Y. & Sellen, A. 2008. *Being Human: HCI in the Year 2020*. Copyright ©2008, Microsoft. Used with permission from Microsoft.
CHAPTER 1

Introduction

The world is messy, fuzzy, sticky, theoretically ’tis all quite tricky. (Tom Erickson, 2002)

1.1 BURGEONING HCI

The field of human-computer interaction has burst its seams. Its mission, raison d’être, goals and methodologies, that were established early on, have expanded and dissolved to the point that “HCI is now effectively a boundless domain” (Barnard et al., 2000, p221). Everything is in flux, arguably, more so than ever before: the theory that drives research is changing, a flurry of new concepts have emerged, the domains, topics and user experiences being studied have diversified; many of the ways of doing design are new and much of the technology and user experience that is being designed for, in terms of platforms, applications, services, ecologies, etc., is significantly different from ten years ago. The focus is no longer about human-computer interaction per se, but more about “the creation of intuitive, simple, transparent interaction designs which allow people to easily express themselves through various computationally enhanced tools and media.” (Bannon, 2011a, p17). These changes reflect and capitalize on the rapid advances that have occurred in computing and computation (see Grudin, 2012, for an extensive historical overview of HCI and related fields).

While potentially much is to be gained from such burgeoning growth, the downside is a worrying lack of direction, structure and purpose in the field. What was originally a confined problem space with a clear focus that adopted a small set of methods to tackle it — that of designing computer systems to make them more easy and efficient to use by a single user — has now turned into a more diffuse space with a less clear purpose as to what to study, what to design for and which methods to use. It is now widely accepted that a specific problem space does not have to be identified, but an opportunity to design for the unimagined and possible, is suffice. Moreover, global challenges that previously were considered the realms of government and politics are now being promoted as major research topics for HCI, for example, reducing global poverty through social media, mobile and other technologies (see Shneiderman, 2011). At the same time, some have moved into uncharted territories where even taboo subjects are analyzed. Many more topics, areas and approaches are being published in HCI venues, including technology-enhanced sex, religion and food.

It is inevitable for a field that has become increasingly concerned with society, everyday living and progress to have growing pains. A danger, however, of a nascent field, growing so fast and without checks, is it spiraling out of control. There is no longer a consensus of its purpose or indeed what criteria to use to assess its contribution and value to knowledge and practice. No sooner does
2 1. INTRODUCTION

an official body, such as the ACM, derive a charter for HCI, it is out of date. For example, the
definition of HCI prescribed by ACM’s SIGCHI on its website (SIGCHI, 2012) is restricted to
“the study and practice of the design, implementation, use, and evaluation of interactive computing
systems,” whereas there is much more happening in HCI today — judging by what is presented
at conferences, workshops, etc., and discussed in the blogosphere. Do we try to stem the tide and
impose some order and rules or let the field continue to expand in an unruly fashion?

Is HCI now CSCW, Human Factors and Ubicomp, too?

Human-computer interaction (HCI) is generally accepted as the umbrella
term for a field that includes and overlaps with several other fields and areas
(see Figure 1.1).

![Diagram: The relationship between contributing academic disciplines,
design practices and interdisciplinary fields concerned with interaction
design (from Rogers et al., 2011).]

The initial vision was of an applied science that could use cognitive science
theories and methods to inform the development of software (see Carroll,
2003). The goal was to understand how people make use of computational
systems and devices and how they could be designed to be usable and useful. Since its inception, several other fields and approaches concerned with people, design and technology have emerged, some splintering from HCI and others evolving from different disciplines; these include CSCW, Ubicomp, cognitive ergonomics, social computing and interaction design. The difference between these and HCI is largely one of focus, in terms of the different methods, philosophies and lenses that are used to study, analyze, and design computers. Another is the scope and problems they address, where specific kinds of topics may be emphasized. For example, Information Systems is concerned with the application of computing technology in domains like business, health and education, whereas Computer-Supported Cooperative Work (CSCW) broke away from HCI’s single user unit of analysis, at the time, to focus on how to support multiple people working together using computer systems (Greif, 1988).

While the newer fields have carved out their distinctiveness in terms of framing, rhetoric and identity to set them apart from each other and HCI, HCI keeps recasting its net ever wider, which has the effect of subsuming them. For example, the topics covered by many papers that first appeared in a CSCW or an Ubicomp conference are now equally at home in the ACM’s CHI conference. While it is in the interest of the “other” fields to maintain their distinct boundaries and separateness from HCI, HCI does not have to reciprocate. Its tendency towards inclusiveness means it will continue to expand, sometimes at the expense of others losing ground.

In an attempt to pin down a definition that reflected the changes afoot in the field, Jenny Preece, Helen Sharp and myself chose the title *Interaction Design: Beyond HCI* for the three editions of our textbook (Preece et al., 2003; Rogers et al., 2011; Sharp et al., 2007). We considered the term Human–Computer Interaction was no longer representative, with its focus on a single user and computer. Instead, the more general term “interaction design” was considered to be more encompassing, covering a wider range of design, people (sic) and interaction aspects: “designing interactive products to support the way people communicate and interact in their everyday and working lives.” (Rogers et al., 2011, p9) But even this definition misses out on much of the day-to-day practice of interaction design, both in academia and industry. In particular, it fails to capture recent trends, for example, of putting human values first, such as ethics (Harper et al., 2008) and moves towards doing research “in-the-wild” (Rogers, 2011).
A number of sources of inspiration and knowledge have been used to inform design and guide research in HCI, including paradigms, theories, models, frameworks and approaches (Carroll, 2003; Rogers et al., 2011). These vary in terms of their scale and specificity to a particular problem space. At the highest level is a paradigm; this refers to a general approach that has been adopted by a community of researchers and designers for carrying out their work, in terms of shared assumptions, concepts, values and practices. At the next level is a theoretical approach or perspective that refers more generally to the assumptions about a phenomenon being studied or designed for, the lenses used to analyze it and the questions asked, that are grounded in a theoretical tradition, for example, within social psychology, design or engineering. A theory is a well-substantiated explanation of some aspect of a phenomenon, for example, the theory of information processing that explains how the mind, or some aspect of it, is assumed to work. A model is a simplification of some aspect of HCI, intended to make it easier for designers to predict and evaluate alternative designs. A framework is a set of interrelated concepts and/or a set of specific questions that is intended to inform a particular domain area, e.g., collaborative learning, online communities or an analytic method, e.g., ethnographic studies. A number of frameworks have been introduced in HCI to help designers constrain and scope the user experience for which they are designing. They can come in a variety of forms, including steps, questions, concepts, challenges, principles, tactics and dimensions. For example, there are frameworks for helping designers think about how to conceptualize learning, working, socializing, fun, emotion, etc. and others that focus on how to design particular kinds of technologies to evoke certain responses, e.g., persuasive technologies and pleasurable products.

**HCI Paradigms**

In general, a paradigm provides a set of practices that a community has agreed upon (Rogers et al., 2011). These include:

- questions to be asked and how they should be framed;
- phenomena to be observed;
- how findings from studies are to be analyzed and interpreted.

In the late 1970s and 1980s, the prevailing paradigm in human-computer interaction was how to design user-centered applications for the desktop computer. Carroll (2003) talks about this first decade of HCI as the Golden Age — in the sense that there was a general agreement about what it was about, what it strove for and what it could achieve — which it turns out was considerable. Questions about what and how to design were framed in terms of specifying the requirements for a single user interacting with a screen-based interface. Task analytic and usability methods were developed based on an
individual user's cognitive capabilities. The acronym WIMP was used as a way of characterizing the core features of an interface for a single user: this stood for Windows, Icons, Menus and Pointer. This was later superseded by the GUI (graphical user interface), a term that has stuck with us ever since. Within interaction design, many changes took place in the mid-to-late 1990s. The WIMP interface with its single thread, discrete event dialog was considered to be unnecessarily limiting (e.g., Jacob, 1996). Instead, many argued that a new paradigm was needed to enable more flexible forms of interaction to take place, having a higher degree of interactivity and parallel input/output exchanges. A shift in thinking, together with several technological advances, paved the way for a new way of conceptualizing human-computer interaction. The rhetoric "beyond the desktop" became a pervasive starting point, resulting in many new challenges, questions and phenomena being considered. New methods of designing, modeling, and analyzing came to the fore. At the same time, new theories, concepts and ideas entered the stage. Weiser's (1991) vision of the future also provided an alternative paradigm in the field of ubiquitous computing.

To summarize, paradigms, theories, models and frameworks are not mutually exclusive but overlap in their way of conceptualizing the problem and design space, varying in their level of rigor, abstraction and purpose. Paradigms are overarching approaches that comprise a set of accepted practices and framing of questions and phenomena to observe; theories tend to be comprehensive, explaining human-computer interactions; models tend to simplify some aspect of human-computer interaction, providing a basis for designing and evaluating systems; and frameworks provide a set of core concepts, questions or principles to consider when designing for a user experience. Within HCI, many researchers attempted to develop different kinds of conceptual tools that could be applied to HCI and interaction design.

But as the new approaches, ideas and theories proliferate within HCI, it can make it problematic for those inside and outside to know what are the current acceptable, reliable, useful and generalizable findings and advances in knowledge. Researchers and designers, alike, also find it more difficult to say with confidence what HCI is, and to know which of the many tools and techniques to use, when doing design and research. The criteria available for them to help make systematic judgments are often disparate, and many a student may select a technique, theory and set of methods on a "pick and mix" basis. Some might argue that such arbitrariness does not matter so long as the outcomes of HCI can be shown to have an impact on society that is supported by evidence. Others, however, feel uncomfortable that the field is losing its rigor and reason.

Nearly ten years ago I addressed these concerns in an extensive review paper about the impact of the then recent developments of theory in HCI practice, by taking stock and reflecting on the numerous changes that were happening (Rogers, 2004). I critiqued the seminal theoretical devel-
1. INTRODUCTION

Opinions of the time, assessing and ruminating more generally on the role of theory in HCI. A core concern running throughout the review article was the extent to which theory was used in design practice. I noted how a diversity of new theories had been imported and adapted in the field. A key question I raised was whether these attempts had been productive in terms of knowledge transfer. By knowledge transfer, I was referring to the translation of research findings (e.g., theory, empirical results, descriptive accounts, cognitive models) from one discipline (e.g., cognitive psychology, sociology) into practical concerns that could be applied to another (e.g., HCI, CSCW). An empirical study of designer’s use of theory that I conducted made for rather depressing reading, especially for those championing theory in practice (Rogers, 2004). Despite designers’ perceived need and desire for applying theory, they reported in the survey that they were only able to make use of some of it in a limited way. I concluded by proposing new knowledge transfer mechanisms, including a lingua franca that designers and researchers, alike, could use to talk to one another more.

1.3 AIMS OF THE BOOK

So what next? The purpose of this book is, firstly, to revisit the concerns surrounding the role of theory in an applied and rapidly changing field, by examining its place and value in the field in the interim years. Secondly, to consider the ramifications of this for a field that has become everything and anything, in an attempt to keep up with, understand and be part of a technology-pervasive world that is radically transforming how we live. Thirdly, to discuss what it means for the advancement of a field and its knowledge where its theory industry has become so multifarious.

Clearly, it is impossible to do justice to all the theories that have been imported and written about in HCI (and overlapping disciplines) in one book. There is inevitable bias in what is covered here; some theories are covered in depth, while some are briefly touched upon (such as those in CSCW and cognitive ergonomics). My objective here is to provide an overview of the theoretical developments, but to give more space to those that have been most influential in HCI (e.g., Distributed Cognition, Activity Theory), providing more in-depth discussion of their use and impact. For each theory, I describe how it has been imported, adapted and its impact on research and practice. I have also included a number of approaches that are not considered to be theoretical but are methodological in nature. The reason for their inclusion is that they have played an integral part in other theoretical developments within HCI. These are primarily grounded theory and ethnography and I have also included approaches that are considered largely or wholly atheoretical, namely, ethnomethodology and situated action. These were included because of their impact. Besides being influential in shaping the field, they have often been highly critical of existing theories in HCI, and alternatively, promoting radically different ways of framing human-computer interactions, phenomena and data.

As Grudin notes (personal communication), a method, such as an experiment or observation, is not a theory. However, the outcome of using a method to collect data is often used as input for theory construction or theory testing and hence, in my view, it is important to consider methods in relation to theory. While it is generally accepted that there is a distinction between method and theory, it is argued that they are intertwined, especially in terms of how they are used and developed.
in HCI. Hence, my position in this book is to adopt a broad-brush approach to theory in HCI. Instead of restricting myself to using the term “theory” in the narrow scientific tradition, I have chosen to show how theory, in all its forms and guises, has been adapted and contextualized in HCI practice.

1.4 PARALLELS WITH ART HISTORY

To frame the history of HCI theory, I borrow, loosely, from the periodization of the History of Art, characterizing it in terms of three parallel movements: Classical, Modern and Contemporary. I critique Classical theoretical developments and the role they have played in the field, followed by an overview of Modern and Contemporary theories. Previous attempts to characterize the history and the significant developments in HCI have conceptualized them more generally in metaphorical terms of waves, paradigms or circles (e.g., Bødker, 2006; Grudin, 1990; Harrison et al., 2007). My intention of adding yet another framing to the mix — this time as parallels to epochs in the History of Art — is to provide a different historical lens, which, I think, lends itself to understanding the way different theories have come and gone, and the zeitgeist behind their development. The parallel with the History of Art is at the level of distinctive periods, such as Classicism and Modernism that denote the style and philosophy of the art or theory produced during each of them.

Classical Art began with the Greeks and Romans and their interpretation and formal representation of the human form and the environment in which it exists. It adheres to artistic principles and rules laid down by painters and sculptors. Much training was required to become an artist of classicism. Well-known movements included Gothic, Baroque, Flemish and Pre-Raphaelite. Modern art took over in the late 19th century and lasted until the 1970s. This period is associated with art in which the previous classical traditions were thrown aside in the spirit of new ideas and experimentation, rethinking the nature of materials and the function of art. Notably, there was a move towards abstraction. For instance, Henri Matisse, Georges Braque, André Derain and Raoul Dufy totally transformed the Parisian art world with wild, expressive landscapes and figure paintings. Contemporary art then emerged in the 1960s/70s and is still with us today as the dominant movement. There are many different kinds of contemporary art, including well-known ones such as pop art, performance art and postmodern art and more obscure ones such as VJ art, cynical realism and superstroke. Collectively, contemporary art is considered to be more self conscious and socially conscious than previous eras, concerning itself with popular culture and political developments of the time, including feminism, multiculturalism and conceptualism.

Similar to these three periods of art history, the defining spirit or mood of the three eras of HCI theory can be viewed as being underpinned by the ideas and beliefs of the time. The Classical HCI period imported cognitive theory in a rigorous and constrained way; the Modernist HCI period saw a broader and colorful palette of approaches and uses of theory — from social, phenomenological and cognitive science — while the Contemporary period became more value-led, drawing from a range of moralistic and societal-based perspectives. Each has significantly extended the discourse of HCI research.
1. INTRODUCTION

However, at the same time, many of the theoretically based approaches that have been pro-
mulgated in each period have had only a limited impact on the practice of interaction design. Why
is this so? The book discusses this dilemma and concludes that HCI theory is now at a crossroads.
It can continue to address moderately sized issues (i.e., small HCI) or it can try to tackle even
bigger challenges (i.e., big HCI). While modernist theories can continue to deal with micro HCI,
having an input into the design of new experiences and technologies, different kinds of theories are
needed to better articulate and ground macro-HCI, to encompass the complex challenges facing
society (Shneiderman, 2012).

In the next chapter, I provide a brief overview of how HCI grew alongside the technological
developments that were taking place. In Chapter 3, I summarize the various roles and contributions
theory has made to HCI. Then in Chapters 4, 5 and 6, I provide an overview of the three periods of
HCI theory. Chapter 7 discusses the reasons behind the success and failures of theory being applied
in practice. Finally, Chapter 8 looks to the future, asking where theory will go next.
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
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
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
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.