

**EXPLORING A TECHNOLOGICAL HERMENEUTIC:
UNDERSTANDING THE INTERPRETATION OF
COMPUTER-MEDIATED MESSAGING SYSTEMS**

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**EXPLORING A TECHNOLOGICAL HERMENEUTIC:
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COMPUTER-MEDIATED MESSAGING SYSTEMS**

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To my favorite...

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SUMMARY

Empirical evidence suggests that individuals can hold different interpretations of a technology. In this research, I explore the question of where these different interpretations come from. What influences an individual's interpretation of a technology? And what is the nature of these interpretations? I explore these questions through studies of computer-mediated messaging systems, including instant messaging, photo-enhanced instant messaging, multimedia messaging (cameraphones), and mobile messaging (BlackBerries). In this research, I draw from philosophical hermeneutics, a domain of study examining the nature of interpretation, and present a technological hermeneutic, a descriptive theory of how individuals interpret technology—how they come to understand the meaning of technology in their own lives. This theory offers insight into the myriad resources individuals draw from when constructing an interpretation of technology, including their own experiences with related technologies as well as their interactions with others' use and understanding of the technology. This theory also offers insight into the nature of the interpretive process. Interpretations are dynamic and evolving; individuals continually draw from new experiences, reengaging and reinterpreting technology. Interpretations are also hybrid and synthesized; individuals draw from multiple resources in an active process of interpretive bricolage.

PART 1
A HERMENEUTIC PERSPECTIVE ON THE MULTIPLE
INTERPRETABILITY OF TECHNOLOGY

CHAPTER 1

INTRODUCTION

MOTIVATION

My purpose in briefly recounting my own intellectual...journey... has been to dispel that illusion of anonymous, objectively authoritative, and disinterested scholarship that written texts in general, and academic ones in particular, seem to generate. By revealing my own historical development and social location within its particular limitations, interests, and inevitable blind spots I intend to invite my reader into a critical dialogue that I anticipate will involve questioning and disagreement (Schneiders, 1999).

This text is the result of seven years of research exploring computer-mediated communication—studies of various forms of instant messaging, multimedia messaging and mobile messaging—along with a not insignificant amount of self-discovery. Over the course of those seven years, I followed a thread of research questions about why people use (or do not use) technology. So much of the research I was reading at the time kept telling me how people used technology and for what purpose. What I wanted to understand was why people used technology in the ways that they did.

Grounded in a deep respect for the individual, these were questions that I had to find answers to one person at a time. And I had to allow that the answers I would hear would be fundamentally subjective. Why someone uses technology in the way that they do is an intensely personal and subjective question. Anyone who is interested in the design and use of technology ought to care deeply about what people believe...even if they do not share the same beliefs and even if they think some of those beliefs are bizarre or baseless.

Peoples' beliefs are inextricably intertwined with how they interact with the world and the technology in that world. Subjective beliefs are powerful forces at work on technology and should be better understood. I do not believe that by placing value on the subjective experience that one abandons science; on the contrary, I believe that subjective experiences are a phenomenally (pardon the pun) compelling object of investigation—as real as observable phenomena...just perhaps a little more tricky to get at methodologically.

Over the past seven years, the unit of analysis in my research has evolved, then, to focus on the subjective individual experience. This unit of analysis is an essential (although not exclusively so) starting point for understanding why people use technology in the way that they do. It is also an unabashedly moral stance. I believe that individual voices deserve to be heard; I believe that individual perspectives are valid and important.

But the subjective individual experience is not a constructive ending point for research that aims to influence subsequent generations of computational technology. One cannot pragmatically design and release technology for one individual's subjective beliefs; one certainly cannot enact farther-reaching infrastructure to support one individual's subjective beliefs. Although I firmly believe in the primary importance of individual perspectives, I also believe that many individuals will share similar or similar enough beliefs about technology, as a result of having shared cultural experiences, for example, to suggest more generalizable lessons for design.

MY RELATIONSHIP TO COMPUTATIONAL TECHNOLOGY

My relationship to the domain of computer science is open to multiple interpretations. Once this text is accepted for publication, I will have been conferred two degrees from the Georgia Institute of Technology's College of Computing. I have written code in multiple programming languages that has been deployed and used for research studies. These research studies have been published in venues where computer scientists publish research. And my relatives certainly consider me enough of a computer expert to call and ask all sorts of questions when their computers cease to work as they expect they should.

However, surrounded by self-identified computer scientists for the past seven years, I have never been able to participate in the ritualistic conversation that seems to admit and locate people within their computer science “pack”:

Wow. I haven’t seen anything like this since the Commodore 64.

Oh, no kidding. Those were the days...all of those brilliant 4 color graphics. And that disk drive. Wow. I remember trying to get my TRS-80 to do half of that.

You hacked on the TRS-80? That thing was such a beast! Man, those were the days.

Yeah. Good times.

For better or for worse, I cannot participate in a conversation about the variety of “old school” technologies I have hacked. I did nothing but take typing lessons, play Oregon Trail, and write essays on computers until I got to college. At college, I learned a lot about computers. Some of the most important things I learned, however, I learned before I ever took my first programming course as an elective in the final semester of my final year.

In the fall of 1995, I enrolled in my first semester of college as an elementary education major, bought my first personal computer, and moved into my first dorm. One of the first people I met in the dorm was a computer science major. He introduced me to the Internet, signed me up for my first email account, and showed me one of his first class projects—a computer-based version of the card game Set. From this friend, I learned that computers were absolutely fantastic and somewhat magical things.

Around that same time, I took my own computing course for students in the College of Education. We had to learn how to keep grades in Excel, convey course material in PowerPoint, and create web pages to present multimedia curricula. On the first day of class, the professor announced that if we already knew enough about computers to hand in all the assignments, we could submit everything on our own and not attend lectures. There was laughter throughout the lecture hall at this. “As if,” they laughed, “as if we

could pass this course without attending the lectures.” From these peers, I learned that computers were incredibly difficult and intimidating things.

This text is part of my journey to make sense of the intuition that somehow my friend and my peers were both right.

The philosopher Paul Ricoeur has argued that people approach artifacts and experiences both from positions of faith and positions of suspicion (1970). I approach technology from positions of both faith and suspicion. Technology, in general, or the abstract potential of technology, I approach with faith. Perhaps it is unavoidable when surrounded by computer scientists; I am optimistic about new technologies. I want them to be fantastic. I want to fall in love with them. I want them to change my world. I know that computational technologies have the capacity to be and do all of these things. I love my laptop. I have written most of this text while sitting in a very comfortable armchair in front of a fireplace at a cafe where the barista will refill my cup of tea for as long as I sit there. I love my personal video recorder (which isn't really personal; I share it with my husband). I love being able to wind down in the evenings on my own terms without dropping everything at 11:00 PM to watch *The Daily Show* and I love having a queue of saved recordings of Food Channel specials documenting the work of small, independent candy companies.

But I am more likely to approach specific, new-to-me technologies from a position of suspicion. My experiences with many technologies have been great disappointments. All too often, I see the potential of technology mismanaged or embodied in ways that just do not mesh with my lifestyle or values.

I study technology wanting to see the world changed for the better. I listen for inspiration in the voices of people who find the technology to be wonderful and magical, but often find myself most relating to the voices of people who, in the end, struggle to learn to use the technology or to find a place for the technology in their lives.

OUTLINE AND OVERVIEW OF RESEARCH

In my studies of computer-mediated communication, I had not originally set out to contribute a technological hermeneutic. I had set out more simply to understand the use of computer-mediated messaging systems. Much of the research I discuss in this text has been published elsewhere in an original form that, in fact, makes no mention of hermeneutics or even of interpretations. The clues were all there. It took me seven years to see them and to find the right language with which to discuss them.

Although this text may certainly be viewed in light of my intellectual journey, it is not, as a whole, organized as an explicit account of and reflection on this journey. Rather, I have tried to focus on unpacking a technological hermeneutic that can be triangulated across studies of computer-mediated messaging systems and across an evolving set of motivations and methodological choices. Because of this, the astute reader may be able to identify some theoretical and methodological inconsistencies in the research being discussed, but I have hopefully achieved a theoretical narrative that is more true to itself, in exchange.

In one subsection of this text, however—the empirical basis of this research—I have chosen to present the research in chronological order and in its original form. I have done so primarily to maintain the integrity of the individual pieces of research, from motivation to methodology and from rhetoric to results, and to help steer readers clear of the erroneous assumption that each piece of this research was undertaken from a consistent and unchanging epistemological stance and as an exploration of a technological hermeneutic. In addition, by presenting each study in its unaltered form, I hope to suggest to the reader how fundamental the interpretation of technology is, that even when a study is not undertaken explicitly to explore it, characteristics of and questions surrounding interpretation can still be highly visible.

In Part 1 of this text, I introduce the reader to this research and the construct of technological interpretations. In Chapter 2, I motivate the need for theories of interpretation in human-computer interaction and suggest

ways that the interpretation of technology has become increasingly salient throughout a history of incredible technical innovation (Vaida & Mynatt, 2008a). Here, I also provide an overview of theories that expose different facets of the multiple interpretability of technology. In Chapter 3, I focus more specifically on the relationship between hermeneutics, a domain of the study of interpretation, and computational technology, foreshadowing themes of relevance to the exploration of a technological hermeneutic.

In Part 2 of this text, I step back and present a series of studies of computer-mediated messaging systems:

- In Chapter 4, I present a study of instant messaging in which I identified tensions resulting from the adoption of conflicting conventions of use from other related communicative genres (Vaida, Newstetter & Mynatt, 2002). I gathered 61 instant messaging transcripts from 8 participants over a two-week period and conducted follow-up interviews to elicit accounts related to a few specific observations regarding the transcripts.
- In Chapter 5, I present a second study of instant messaging (Vaida, Erickson, Kellogg, & Mynatt, 2004). In this study, I gathered experience sampling data about the instant messaging use of 10 participants over the course of 10 days. In this research, I began to engage a more interpretive approach to research, exploring the breadth of meanings that individuals ascribe to instant messaging.
- In Chapter 6, I present a study of photo-enhanced instant messaging (Vaida & Mynatt, 2005b; see also Vaida & Mynatt, 2006). In this study, I designed and deployed a photo-enhanced instant messaging client. I studied the ways that photographs were used in a communicative context, exploring the myriad media and technologies that historically evidenced similar themes of appropriation. Eight participants used the instant messaging client for four months and I collected 202 transcripts, including 806 photographs.
- In Chapter 7, I present a study of multimedia messaging and cameraphones (Vaida & Mynatt, 2008c). In this study, I began to explore

individuals' interpretations of technology more in depth. I conducted 14 hours of semi-structured interviews about the multimedia messaging and cameraphone use of 6 members of an extended family over a two-month period. These interviews were grounded in copies of 36 cameraphone photographs and transcripts from voicemail experience sampling. From an analysis of this data, I identified three interpretations of cameraphones held by different members of the extended family.

- In Chapter 8, I present a study of multimedia messaging/cameraphones, mobile messaging/BlackBerries, and iPods (Volda & Mynatt, 2008b). In this study, I explored a variety of social and organizational resources that individuals draw from in their interpretation of technology (e.g., pricing plans, advertisements and news stories). I drew from the 64 survey responses to characterize the nature of interpretation.

In part 3 of this text, I synthesize across studies to present a technological hermeneutic, addressing questions of what influences individuals' interpretations of technology as well as what is the nature of the interpretive process (Chapter 9). Finally, I reflect on how this technological hermeneutic might be appropriated by the human-computer interaction community (Chapter 10).

CONTRIBUTIONS

The contributions of this research exist at two levels. First, this research contributes to the knowledge base of research in computer-mediated communication:

- identification of tensions in *instant messaging*, attributed to conflicts and ambiguity among the multiple, overlapping conventions of verbal and written communication (Volda et al., 2002);
- identification of a breadth of meanings ascribed to *instant messaging*, including results indicating that meanings transcend the boundaries of work-related and social communication (Volda et al., 2004);
- identification of themes of appropriation in multimodal, photo-enhanced *instant messaging*, where each theme can be traced historically to themes

of appropriation in related media and technology (Volda & Mynatt, 2005b);

- identification of interpretations of *multimedia messaging* and cameraphones, each related to individuals' previous experiences with related technologies (Volda & Mynatt, 2008c); and
- characterization of the influence of pricing plans, advertisements, news stories, and the habits or experiences of friends, colleagues, or family members on the use and interpretation of *multimedia messaging* (cameraphones) and *mobile messaging* (BlackBerries) (Volda & Mynatt, 2008b).

Second, this research contributes a technological hermeneutic, a descriptive theory of how individuals interpret technology—how they come to understand the meaning of technology in their own lives. This theory offers insight into the myriad resources individuals draw from when constructing an interpretation of technology, including their own experiences with related technologies as well as their interactions with others' use and understanding of the technology. This theory also offers insight into the nature of the interpretive process. Interpretations are dynamic and evolving; individuals continually draw from new experiences, reengaging and reinterpreting technology. Interpretations are also hybrid and synthesized; individuals draw from multiple resources in an active process of interpretive bricolage.

CHAPTER 2

A TRAJECTORY TOWARD MULTIPLE INTERPRETABILITY IN HUMAN-COMPUTER INTERACTION

INTRODUCTION

Since the advent of mainframe computers in the 1950s, the sheer diversity of computing technologies has expanded exponentially. This expansion fueled and was fueled by a complementary rise in the diversity of users of the technology, the diversity of tasks and activities for which the technology could be used, and the diversity of contexts and cultures in which technology could be used. As people's exposure to technology has increased and diversified, there has also been an increased potential for individuals to come to a greater diversity of understandings about what technology is and means in the context of their lives. Examples abound. Is a shared calendar system a mechanism for optimizing the scheduling of meetings or a means for supervisors to monitor workplace activities (Palen, 1999)? Is home automation a relief from burden on the Sabbath or a technological "cheat" (Woodruff, Augustin & Foucault, 2007)? Are Roombas™ vacuum cleaners or mechanical pets (Sung, Guo, Grinter & Christensen, 2007)? The multiplicity of peoples' interpretations of technology has become more apparent as larger numbers of people have been exposed to a greater diversity of technologies. Thus, the need for theoretical grounding that acknowledges this diversity of experience, understanding, and interpretation has increased substantially.

It is not surprising that the early voices of HCI theory explicitly and implicitly assumed there was a singular interpretation of computing technologies. Early uses of mainframes, after all, involved only one user. Over time, the canonical one-to-one human-computer interaction has changed significantly.

Despite these changes, the normative stance of HCI theory still assumes there is a singular interpretation of a technology.

Within the field of HCI, there is, however, disagreement about whose technological interpretation should have primacy—that of the user or that of the designer (Sengers & Gaver, 2006). To borrow from Sengers' and Gaver's exemplars, mental models research (e.g., Norman, 1986) relies on the underlying assumption that the designers' interpretation is the single, authoritative one. From this perspective, the challenge of design is to clearly convey the designers' interpretation. In contrast, user-centered design (e.g., Beyer & Holtzblatt, 1998) and participatory design (e.g., Kyng, 1994) rely on the underlying assumption that the users' interpretation is authoritative. In this case, the challenge is to understand users' interpretations and embody them in design. This kind of Kuhnian paradigm conflict (Kuhn, 1996) has placed designers and users in subtle competition with each other to define technologies that are, in reality, co-constructed (e.g., Bolter & Grusin, 1999; Gadamer, 2005; Hall, 1980; Mackenzie & Wajcman, 1985; Oudshoorn & Pinch, 2003).

Scholars in numerous disciplines have studied the multiple interpretability of technology, including science and technology studies (e.g., Mackenzie & Wajcman, 1985; Oudshoorn & Pinch, 2003; Pinch & Bijker, 1984; Trescott, 1979), cultural and media studies (e.g., Bolter & Grusin, 1999; du Gay, Hall, Janes, Mackey & Negus, 1997; Hall, 1980; Mackay, 1997), and philosophy (e.g., Gadamer, 2005; Grondin, 1994; Ihde, 1998; Jasper, 2004). Among this multidisciplinary body of research are numerous empirical studies of technology use documenting the multiple interpretability of technology as well as theories and models of technology use that reflect the multiple interpretability of technology. The multiple interpretability of technology was explicitly introduced into the research dialogue within HCI by Sengers and Gaver (2005; 2006). Sengers and Gaver have called attention to the ability of users, in particular, to construct multiple interpretations of technologies and to advocate for the field to (a) encourage multiple interpretations by

nurturing ambiguity in design and (b) validate multiple interpretations through a broader understanding of the role of evaluation in HCI.

In the first half of this chapter, I present a history of human-computer interaction. This history is inspired by and modeled after the histories of human-computer interaction that have been presented elsewhere by Grudin (1990) and Dourish (2001), each retelling a familiar history in a new way in order to focus the attention of the research community on important and emergent theoretical issues. I trace two parallel threads through the history of computation. The first thread relates innovations in computing technologies to the increasing diversity of users, activities in which computing technologies are used, and surrounding contexts of use. The increased diversity of exposure suggests an increased diversity in the possible interpretations of technology held not just by users but also by non-users, designers, organizations and other entities. The second thread relates the history of theory in HCI to the increased diversity of users, activities, and surrounding contexts of use.

In the second half of this chapter, I present three theoretical models that reflect processes of the interpretation of technology. Each of these theories is drawn from a different discipline and calls attention to different aspects of interpretation and its consequences for the design community. Specifically, I present: (1) the hermeneutic circle, a cycle of interpretation from philosophy that describes the process of interpretation between an individual interpreter and an interpreted artifact, each situated in a cultural context; (2) the circuit of culture, a cycle of five cultural processes from the discipline of cultural studies that intertwine in highly contingent ways and foreground new interpretations of technology from multiple stakeholders; and (3) the process of remediation from media studies, a theory that takes a longitudinal perspective situating the interpretation of technology with respect to a continually evolving ecology of related media and technologies. Each theory pays heed to the active role of individuals and groups as the processes of interpretation play out and into larger cycles of design. From this

perspective, I believe that each of these theories is entirely in keeping with the user-centered stance held by the HCI community.

Throughout the historical discussion of theoretical work in HCI and the discussion of theories reflecting the multiple interpretability of technology, I draw from Halverson's articulation of four roles of theory in Computer-Supported Cooperative Work:

- Description: A theory should “provide a conceptual framework that helps us make sense of and describe the world.”
- Rhetoric: A theory should “help us talk about the world by naming important aspects of the conceptual structure and how it maps to the real world.”
- Inference: A theory should “help us make inferences. In some cases those inferences may be about phenomena that we have not yet understood sufficiently to know where or how to look.”
- Application: A theory should “inform and guide system design” (Halverson, 2002).

My goal in this chapter is to demonstrate that HCI theory has progressively broadened to reflect the increased diversity of computer use, fostered by a historical succession of computational innovations. I argue that the time has come to endorse a larger theoretical landscape that embraces an additional form of diversity—the diverse interpretations of technology. My subsequent goal, then, is to offer a survey of theories that embrace and reflect upon the multiple interpretability of technology. This set of theories provides an initial description of the multidisciplinary theoretical terrain of multiple interpretability. As Halverson has described, “Theories are more like a pair of dark glasses. We put them on and the world is tinted. The change brings some objects into sharper contrast, while others fade into obscurity” (2002). In this survey of theories, I offer new glasses with which the field of HCI can bring the multiple interpretability of technology into sharper contrast and see the world of technology use in a different light.

A HISTORICAL TRAJECTORY TOWARD MULTIPLE INTERPRETABILITY

Mainframe Computing

The tendency of human-computer interaction to consider a single interpretation of technology is eminently reasonable considering the origins of computation. Early in the history of computers, there was, in fact, only one user. That user was a trained expert since, as Dourish has observed, computing time was more expensive than human time (2001). Anyone who required processing power submitted computing tasks to one expert user who served as a computational gatekeeper.

This period in the history of computing predates the domain of human-computer interaction. Interfaces and interaction were viewed as a mechanism for the user to instruct the computer and not as a means of supporting the user in their work¹, but current perceptions about the relationships among humans and computing machinery still have their roots in this computational era.

Multiprocessing & Time Sharing

Momentum toward the necessity of attending to the multiple interpretability of technology began to build with the innovations of multiprocessing and time sharing. With the advent of multiprocessing, a larger number of individuals interacted with the technology, each individual working from his or her own terminal and submitting computational tasks to a shared mainframe.

Multiple interpretations of technology¹ exist, in large part, because multiple individuals interact with technology; multiprocessing first brought those additional users to the attention of computer and cognitive scientists. As was the case with the individual user of the mainframe, these expanded sets of users were still experts, trained to use systems in ways that satisfied the sanctioned and codified interpretations of the designers.

¹ At this point in the discussion, the designers of whom I speak more likely self-identified as system developers. In order to maintain consistency throughout the discussion, I use the term designer to broadly refer to individuals who had a hand in creating computational artifacts.

Early theoretical work in human-computer interaction arose from perceptions of technology use that were constructed in this computational era. Foundational HCI models relied on the assumption that computer users were trained experts and, as such, would operate within the designers' singular interpretation. Most prominent, perhaps, was the Model Human Processor (Card, Moran & Newell, 1983), an engineering approximation of the information-processing representation of cognition that embodied a singular interpretation of an expert user. These theories offered the potential of great predictive power in situations that aligned with their assumptions. In particular, the GOMS family of methods enabled predictions regarding the optimized use of large information systems (John & Kieras, 1996).

The history of this era suggests that one interpretation of technology was considered—the interpretation of the designer. And while the emergence of the domain of human-computer interaction provided guidance to designers about the capabilities and limitations of expert computer users, the theories of the era, in general, assumed that users subscribed to the singular interpretation of the designer.

Personal Computing

The era of personal computing brought with it many technical innovations (e.g., bitmapping and the design of the mouse), but most importantly, it represented an explosion in the number, diversity, and range of expertise of computer users. These new users were not programmers; they were not trained experts. For the first time in the history of computation, designers widely acknowledged that the users of technology would be different from themselves. The explicit rhetoric of many of these designers was that the technology needed to be more accessible and intuitive—even to children (e.g., Kay & Goldberg, 1977). The tacit assumption behind the explicit rhetoric may have been that users might have different interpretations of the technology than its designers.

The user interface came into considerable focus at this time as designers-cum-HCI practitioners tried to ensure that their interpretation of the technology was being communicated in intuitive ways to new users. Accounts

of the development of personal computers convey some of the first examples of end-user testing. Designers at Xerox PARC tested a new word processing program on the Alto on a group of secretaries; designers at Apple tested evolving versions of the Lisa on recruits from new employee orientations (Levy, 1994).

One of the primary means through which designers communicated their interpretation of technology to users was through the use of metaphor. The video display unit became a desktop on which work could be accomplished; the mouse provided a virtual extension of the index finger, allowing users to point at symbolic artifacts in virtual space. These metaphors were, in many ways, the first embodiment and acknowledgement of the designers' own technological interpretations. These metaphors were a form of design-based scaffolding to guide novice users toward the technological interpretations of the designers.

It is important to note here the plurality of designers' interpretations. The multiple interpretability of technology also extends to those who design technology. Some designers interpreted the personal computer as a tool for carrying out common work tasks such as word processing or accounting; others interpreted the personal computer as a medium (Levy, 1994). Critical design decisions were made based on the prevailing interpretation held by or sanctioned by the design leadership of the time.

The field of HCI responded to these technological innovations by developing models that described distinctions between the interpretations of designers and those of users. Norman described the mismatches of three voices—the system, the designer and the user—and articulated how the gaps between these voices created challenges for designers and users (1988). Specifically, Norman's seven stages of actions model drew attention to potential gulfs between users' intentions and the observable affordances and behavior of a computational artifact. Similar in intent and theoretical grounding, the cognitive walkthrough also emphasized potential problems at the intersection of human intent and interface input and output characteristics (Polson, Lewis, Rieman & Wharton, 1992). These theories were the first attempts to model

mismatches between the interpretations of designers and users, but the goal of the models was to enable designers to scaffold users back to the designers' singular interpretation.

The increased diversity of users in this era, along with increased exposure to technology, meant that there were an increased number of possible interpretations of technology. Within the field of HCI, the most pronounced acknowledgements of the increase in possible interpretations were distinctions between experts and novices and distinctions between able-bodied users and those with perceptual, physical or cognitive impairments that prevented a "normal" engagement with the system. These distinctions reflected an implicit acknowledgement that not all models, metaphors, and interpretations were appropriate for all users. Nevertheless, the theories and methodological tools most prominent at the time generally tried to help funnel this diversity back into a singular, coherent model of use that continued to enable now-well-understood methods for design and evaluation, through scaffolding techniques to enable novices to acquire expert models, for example, or accessibility methods to enable translations of input and output (Dix, Finlay, Abowd & Beale, 1998).

Collaborative Computing

Innovations in computational infrastructure, networking and otherwise, ushered in the era of collaborative computing in which a new diversity of users now engaged with and collaborated around a single system. The rise of groupware dominated this era; the functionality of collaborative systems grew to include diverse users and focused on larger system goals such as authoring shared documents, transaction management and software development. The diversity of users became a diversity of others with whom the interpretation of computational technologies had to be negotiated. Groupware was a boundary object (Star & Griesemer, 1989) around which the negotiation of both users' and designers' interpretations could be negotiated and contested. Within the field of HCI, the negotiation and contestation of interpretations often played out in attention to user "roles" in system design (e.g., Edwards, 1996). Within the HCI community, there was

theoretical tension surrounding a debate over whether roles and other work processes ought to be prescriptive or emergent, driven by the interpretations of designers or users (Flores, Graves, Hartfield & Winograd, 1988; Suchman, 1993).

The era of collaborative computing was dominated by workplace systems. The complex socio-technical system of the workplace organizational environment was now coupled with the increasing diversity of users who all collaborated around a single, shared system. Both leading and responding to these changes, a number of theoretical frameworks such as distributed cognition and activity theory emerged within HCI to help designers make sense of these larger, more diverse systems (e.g., Hutchins, 1995; Nardi, 1996). Rhetorically, these theories allowed researchers to call attention to different slices of the socio-technical systems surrounding collaborative computing. For example, activity theory foregrounded the diverse relationships that users have with computational tools and the surrounding community toward accomplishing a goal (Nardi, 1996), while distributed cognition emphasized the transformation of information propagated through diverse systems of humans and technological artifacts (Hutchins, 1995).

Although research and design efforts stemming from this era embraced additional diversity in the richness of complex socio-technical systems, the theoretical understanding of how individuals make sense of a particular technology remained largely unchanged. One important exception was situated action, a theoretical stance that placed rhetorical emphasis on improvisation with technology (and the world at large) in contrast to sanctioned and optimal cognitive behavior (Suchman, 1987). Situated action stands out as recognizing and foregrounding the highly creative (e.g., de Certeau, 1984) and contextual (e.g., Gadamer, 2005) nature of interpretation.

Although a tremendous amount of research surrounding patterns of adoption and technology use in large socio-technical systems has emphasized a diverse social context, this focus on larger systems has, in part, diverted

attention away from questions about the individual's relationship with technology.

Internet Computing

The development of the transmission control protocol (TCP), the Internet protocol (IP), and the widespread availability of Ethernet networking hardware gave rise to the era of Internet computing. With the emergence of the Internet, individuals came to have access to an increased diversity of information from an increased diversity of sources, eventually in many modal forms. Tools for sensemaking (e.g., Russell, Stefik, Pirolli & Card, 1993) and social navigation (e.g., Dieberger, Dourish, Höök, Resnick, & Wexelblat, 2000), for example, became essential. These sub-domains of HCI research, exploring how people make sense of and interpret the vast amount of information available through technology, presaged the need for research addressing how people make sense of and interpret technology. As the scope of networked socio-technical systems extended to encompass large, distributed Internet communities, theoretical work expanded to account for larger, macro-level behaviors, as well. Anderson, for example, characterized the ability of computational technology to make niche information and resources available to specific, interested audiences (2006).

The era of Internet computing also enabled more diverse users to become explicit producers of technology and content. The availability of resources, space, and tools for individuals to create websites, blogs, movies, and mashups confounded traditional notions of users as passive consumers of technology. As individuals became more actively engaged in creating technology and content, they became more active in constructing new interpretations of technology. In many ways, the history of the Internet is a case study in the multiple interpretability of technology—from the original designers' interpretation as an indestructible defense department communication tool to a multinational, multimodal virtual yard sale, for example—co-constructed by technology standards committees, working groups and an active population of consumers and co-producers. The field of HCI has expanded to explore tools that support users as content creators and

users as programmers, fueling and fueled by the increasingly blurred distinction between consumers and producers and the myriad ways that individuals' multiple interpretations of technology were now increasingly being fostered.

Ubiquitous Computing

The decrease in cost and size of computational technology coupled with the more widespread availability of wireless networking gave rise to the era of ubiquitous computing (Weiser, 1991). The decrease in the cost of computation has enabled a diversity of personal computing devices—PDAs, cellphones, digital cameras, digital music players and the integration of these technologies into various convergent form factors—to be more accessible to a greater number of individuals. This accessibility has enabled consumers to exert more interpretive influence through the selection, rejection and varied use of these technologies.

The mobility afforded by the smaller size of computational technology has driven new markets and afforded the exposure of computation to new and more diverse contexts and cultures of use. The diversity of contexts and cultures in which technology is used suggests additional diversity in the interpretations of technology, both from a new diversity in users and from existing users who find new meaning in an old technology because of the new contexts in which they use it. For example, a cellphone can now be a power business tool in the workplace, a safety net when driving home late at night, and an emotional connection to family and friends on weekends at home.

In the era of ubiquitous computing, HCI theory has argued that this increased diversity of contexts and cultures of use can be understood through the appropriation of ethnomethodology (Dourish, 2001), providing rich interpretive accounts of practices surrounding the use of technology (Garfinkel, 1967). Ethnomethodology is not, however, a theory in the sense classically accepted by HCI; it rejects more objective stances with respect to generalizability. It becomes a challenge, if not impossibility, then, for ethnomethodology on its own to offer design guidance or predictive power in

the face of novel situations. It does, however, deeply engage the situated nature of individuals' interpretive interactions with technology and the ways that individuals construct meaning from their interactions.

A FOCUS ON INDIVIDUAL AGENCY

The use of computing technology has changed enormously in just a few decades. The theoretical landscape of HCI is now well populated with methodological guidance at many levels, particularly in understanding the use of technology from the perspective of larger socio-technical systems (e.g., Hutchins, 1995; Nardi, 1996). In this chapter, I want to refocus the theoretical lens on how an individual makes sense of a technology in the context of these larger socio-technical systems. Traditional HCI theory almost exclusively emphasizes cognitive accounts derived from canonical models of system designs (e.g., Card et al., 1983; John & Kieras, 1996). Ethnomethodology (Garfinkel, 1967) and situated action (Suchman, 1987), for example, point to the richness and diversity of peoples' experiences with technology but provide little rhetorical, predictive or design guidance. My aim is to expose a complementary theoretical terrain to help HCI researchers and practitioners engage multiple interpretations as part of standard design practices.

One rhetorical device that helps seed this transition is a shift from viewing individuals as passive "users" of technology to active co-constructors of technology (e.g., de Certeau, 1984; Oudshoorn & Pinch, 2003). When models of people's behavior incorporate this level of human agency, they acknowledge that individuals play an important constructive role in producing the meaning (and now, often, the design and function) of technology. Theories that reflect this level of human agency reflect the powerful influence of individuals as they adopt, reject, modify and re-purpose technologies within larger design processes.

THEORETICAL PROCESSES REFLECTING THE MULTIPLE INTERPRETABILITY OF TECHNOLOGICAL ARTIFACTS

There are a number of theories in various disciplines that reflect the multiple interpretability of technology. The multiple interpretability of technology is one of the core theoretical bases, for example, of the theory of the social construction of technology (Bijker, Hughes & Pinch, 1989; Pinch & Bijker, 1984) and the social shaping of technology (Mackenzie & Wajcman, 1985). Philosophical hermeneutics engages the multiple interpretability of artifacts more broadly (e.g., Gadamer, 2005) while researchers in information systems have applied philosophical hermeneutics as an analytic perspective to their studies of socio-technical systems (e.g., Klein & Myers, 1999).

Theories that reflect the multiple interpretability of technology, in general, share an emphasis on the active role of users in contributing to technological interpretations. The theories differ, however, in the extent of their emphasis on the role of technology in the interpretive process. While one can certainly learn much from theories that focus attention on the social forces at play in the multiple interpretability of technology, and particularly from those theoretical perspectives that highlight the interpretive roles of individuals who have classically been underrepresented in analyses of technology (e.g., Trescott, 1979), I have chosen to foreground those theories that also give significant emphasis to the role of technology in interpretive processes. I believe that the theories that may be most useful to the field of human-computer interaction are those that engage the synergistic interpretive roles of both users and technological artifacts.

In the remainder of this chapter, I highlight three theories—the hermeneutic circle, the circuit of culture, and remediation—that each engage different aspects of the interpretive process and highlight different interpretive interactions among humans and technology.

The Hermeneutic Circle

Within the domain of hermeneutics, an understanding of the multiple interpretability of artifacts significantly predates the emergence of the discussion of the multiple interpretability of technology within the social

sciences. Hermeneutics acknowledges the multiple interpretability of artifacts across individuals (different individuals may interpret an artifact in different ways) as well as within individuals (one individual may interpret an artifact in different ways at different times) (Jasper, 2004). Since its origins, hermeneutics has been a domain of inquiry exploring “our understanding of the nature of texts and how we interpret and use them” (Jasper, 2004). Postmodern hermeneutics, however, has expanded the application of hermeneutics, asserting that people read and interpret a wider breadth of media, artifacts and experiences, such as film, sculpture (Jasper, 2004), human action (Ricoeur, 1981), and technology (Ihde, 1998). Within the sub-discipline of philosophical hermeneutics, philosophers have also gone so far as to claim universal applicability, arguing that “all human behavior is based on making sense of things, even if only unconsciously” (Grondin, 1994; see also Gadamer, 2005).

Originating within the domain of hermeneutics, the hermeneutic circle engages the relationship between the individual interpreter and the interpreted artifact. The hermeneutic circle is an instance of the “chicken-or-egg” conundrum—which came first, the artifact or the interpretation? According to Jasper, the answer is “neither and both” (2004). Of importance here is the assertion that the interpretive process is not linear, from an absence of understanding to understanding via interactions with the artifact. Instead, interactions with technology provide ongoing resources for continued interpretive activity, from technology to interpretation or interpretation to technology and back again.

Different philosophers have described different variations of the hermeneutic circle, placing the circular conundrum at different locations within the relationship between interpreter and artifact. The philosopher Schleiermacher, for example, has described a hermeneutic circle in which the circular conundrum resides entirely within the interpreted artifact, with the interpreter moving between engaging the whole and engaging details of that whole. Jasper summarizes Schleiermacher’s hermeneutic circle as follows:

In order to gain an overview of the text in its completeness, we must give proper attention to the details and particulars. But we cannot appreciate the significance of these details and particulars without a sense of the whole work (2004).

An application of Schleiermacher's hermeneutic circle to the interpretation of technology suggests that individuals move between interpreting technology as a whole, systems or devices, and interpreting the technological details, devices within systems or features and components within devices. One might move, for example, from engaging the meaning of one's cellphone to engaging the meaning of a camera that appeared as a new feature in a recent release: what does a camera mean when it becomes a feature on a cellphone and what does a cellphone mean when it comes to include a camera?

A second variation of the hermeneutic circle places the circular conundrum between the interpreter and the interpreted artifact—between the context in which the interpreter engages the artifact and the context in which the artifact was created. Heidegger has argued that it is much less important to consider how the interpreter breaks out of the hermeneutic circle than it is to consider how the interpreter got into the hermeneutic circle to begin with (Heidegger, 1962). What are the "presuppositions," "presumptions," and "prejudices," then, with which the interpreter began the interpretive process (Jasper, 2004)? Understanding the interpreter's situation enables the "otherness" of the interpreted artifact to be appreciated; cultivating this distinction further enables a dialogue between the interpreter and the creator of the artifact (Grondin, 1994; see also Gadamer, 2005).

An application of this variation of the hermeneutic circle to the interpretation of technology suggests that individuals bring many things to the table when engaging with technology. An understanding of the hermeneutic circle is a methodological reminder to consider the presuppositions, presumptions and prejudices individuals bring to bear on their interpretations of technology and to explore the potential influence of these pre-dispositions on their understanding and use of technology.

The Circuit of Culture

The circuit of culture, drawn from the discipline of cultural studies, models interactions among five major cultural processes that intertwine in a highly contingent manner: representation, identity, production, consumption, and regulation (du Gay et al., 1997; Mackay, 1997). Different interpretations of a technology are expressed through different cultural processes. Multiple different interpretations of technology can be represented, for example, through advertisements (e.g., different ads for the Sony Walkman conveyed that it was “high-tech” device; a youthful, “crazy, zany” device; and a sleek and sophisticated device) (du Gay et al., 1997). Different represented interpretations can reflect existing cultural identities as well as project new identities that organizations are attempting to foster among consumers. Additional interpretations of technology are put forth in the production of technology. In their work as cultural intermediaries, designers inscribe technology with symbolic meaning in addition to function (e.g., an early version of the Walkman had two headphone jacks and was interpreted by designers as a social device (du Gay et al., 1997)) (Bourdieu, 1984). Yet more interpretations of technology are crafted by the creative appropriation work of consumers, who create additional meaning through their everyday practices (e.g., consumers interpreted the Walkman as a way to escape the world around them (du Gay et al., 1997)) (de Certeau, 1984; Mackay, 1997). And finally, regulation intercedes on occasion when multiple and conflicting interpretations of technology become in some way problematic. Of particular importance to proponents of the circuit of culture is the claim that all processes are reflexively influential and continually cyclical; the process of meaning making and interpretation never ends. These theorists assert that although any one process may be the locus for analysis of cultural artifacts, any “adequate” analysis must engage all processes.

The articulation between processes of production/design and consumption/use may be a particularly fruitful frame of analysis for research in HCI. The relationship between production and consumption was engaged as early as the nineteenth century by Karl Marx, who held that consumption

and production were direct counterparts of each other: "Production is...at the same time consumption and consumption is at the same time production" (1980). He asserted that production and consumption were entirely contingent on each other, as well:

A railroad on which no one rides, which is consequently not used up, not consumed, is only a potential railroad.... Without production, no consumption; but, on the other hand, without consumption, no production since production would then be without a purpose (Marx, 1980).

One potential HCI orientation is that the technological artifact is in many ways a boundary object (Star & Griesemer, 1989) between the worlds of production and consumption. The theory of the social shaping of technology argues that technologies embody the culture surrounding their production (Mackenzie & Wajcman, 1985). Consumer culture exerts significant influence over production, not only in what is designed, built and released, but in whether or not the technology is ever adopted. And yet, the technological artifact does exert some influence in return, constraining possible uses and interpretations of the technology (Mackay, 1997). The number of headphone jacks in a portable DVD player, for example, can influence whether or not the technology is interpreted as a social device. And, indeed, the constraining influence of production on consumer culture may also be more political in nature; as extreme cultural intermediaries, designers may actually produce technologies that foster certain forms of politics, whether consciously or unconsciously, implicitly or explicitly (Winner, 1985).

A semiotic lens over the relationship between production and consumption leads to an analysis of technology as text:

Technologies, like other texts are encoded—in a physical sense in their design, and symbolically in their styling and marketing—and are decoded—that is, read by their consumers. At both ends, symbolic 'work' is being done (Mackay, 1997) (See also Hall, 1980).

Designers, as cultural intermediaries, encode “preferred readings” into technology, suggesting the way that a technology might be read (Hall, 1980). A “preferred reading” is not, however, a guaranteed reading. Consumption is an active and creative process, in which consumers construct their own interpretations that may be similar to the preferred reading, but that may also be oppositional to that reading or embody new meanings altogether. Additional meanings constructed by consumers can also become the impetus for redesign (du Gay et al., 1997).

An application of a semiotic lens over the processes of production and consumption to HCI challenges researchers to engage the diverse “readings” of technologies—to interrogate and acknowledge the preferred readings of designers and to deconstruct the variety of similar, oppositional, or entirely new meanings that are constructed by consumers.

Remediation

The process of remediation, drawn from the domain of media studies, orients the analytic focus across the larger ecology of media and technologies (Bolter & Grusin, 1999). Here, the multiple interpretability of technology arises from the ways in which media continually refashion themselves in response to other media:

...media can best be understood through the ways in which they honor, rival, and revise [other media]. No medium today, and certainly no single media event, seems to do its cultural work in isolation from other media, any more than it works in isolation from other social and economic forces (Bolter & Grusin, 1999).

Film photography, for example, has been said to have remediated painting. It was said to explore advances in realism and linear perspective in a way that painting was not able to achieve. But Bolter and Grusin argue that remediation also works reciprocally. The ability of early photography to capture light and color was not particularly refined. Painting, then, remediated photography by exploring aesthetics of light and color. That

remediation, it has been said, was the birth of the Impressionist movement (Bolter & Grusin, 1999; McLuhan, 1994).

Rhetorically, the theory of remediation gives interpretive agency to the media, themselves. This rhetorical stance is shorthand for the agency of “individuals, groups, and institutions that create and use digital media and treat these media as improved forms of [other media]” (Bolter & Grusin, 1999). Here, media does not merely connote the technological artifact, but also the “sum of uses” to which the media is put; the interpretive work of users is part of the media, themselves.

The ways that people draw from existing media and technologies in coming to understand new media and technologies is apparent in the evolving linguistic repertoire that accompanies remediation. Linguist Geoffrey Nunberg points toward “retronyms” as evidence:

That’s usually the way things work when a new technology or new way of doing things appears—we tend to keep calling it by the name of what it replaces, even long after it’s appropriate. We still refer to the luggage compartments at the back of our cars as trunks.... And we’re still talking about dialing telephones, even though the old sort of dial has become such a rarity that we’ve had to invent a new description for it, the “rotary dial.” Rotary dial is what some people call a retronym, a term that expresses a distinction that didn’t used to be necessary (2004).

Computational technology has been fashioned in light of older media and has caused older technologies to be refashioned and renamed. Email was fashioned in light of and has remediated what is now called “surface” or “snail” mail². Online retailers were fashioned in light of and have remediated what are now called “brick-and-mortar” retailers. Digital photography was fashioned in light of and has remediated what is now called film photography.

² Email was also fashioned in light of and has remediated the memo genre (Yates & Orlikowski, 1992). In the ecology of media, multiple processes of remediation can occur simultaneously and involve multiple media.

ROLES OF THEORIES REFLECTING THE MULTIPLE INTERPRETABILITY OF TECHNOLOGICAL ARTIFACTS

The theoretical processes I have presented in this chapter all reflect the multiple interpretability of technology. Each theoretical process focuses its attention at a different level of granularity and on different aspects of the interpretive process. Each theoretical process also serves different roles. As I summarize in Table 2.1, the hermeneutic circle, the circuit of culture and remediation provide different analytic scaffolding for HCI research and design.

The hermeneutic circle suggests a research focus on the relationship between the interpreter and the interpreted artifact. It calls attention to the cyclic process of interpretation moving between the holistic artifact and its constituent parts while also considering the pervasive influence of the surrounding cultural contexts on interpretation. The hermeneutic circle provides inferential guidance by predicting that interpretations will vary based on changing cultural contexts. Overall, the theory points to the importance of coherence between the whole artifact or system and its constituent parts while acknowledging that the iterative interpretative process does not end—contextual shifts in the system will be the catalyst for new interpretations. An individual may reinterpret his or her printer after setting up a new wireless home network, for example.

Integrating this theoretical perspective with current HCI methods offers the potential of “think aloud” protocols that emphasize the movement between the whole artifact and its constituent parts. Experience sampling methods could also aim to capture variances in the interpretations of mobile technologies across different contexts.

Table 2.1 Examples of the theoretical roles of the hermeneutic circle, the circuit of culture, and remediation.

	The Hermeneutic Circle	The Circuit of Culture	Remediation
Descriptive	The interpretive process is a cyclic relationship involving the interpreter and the interpreted artifact, each situated in their own cultural context	Cultural artifacts move through a circuit of five processes that intertwine in a highly contingent manner	Media continually refashion themselves in response to other media in a continually evolving ecology of media
Rhetorical	Gives philosophically generalized names to the interpretive process and names contextual influences on interpretation (e.g., presumptions and prejudices)	Gives names to stakeholders, other processes surrounding interpretation, and classes of interpretations (e.g., preferred, oppositional, etc...)	Abstracts socio-cultural and interpretive assumptions under the construct of "media" enabling discourse at a different unit of analysis
Inferential	Changes to details (features or components) will lead to reinterpretation of the whole (devices or systems)	As the context of the interpreter changes, the artifact will be re-interpreted There will be phases of stability and churn in interpretation as cultural artifacts move through processes in the circuit and as new interpretations are engaged, assimilated, altered, or opposed	The use and interpretation of existing media will change with the release of new media Users will draw from the more familiar conventions and interpretations of existing media when using new media
Application	Suggests extensions to "think aloud" techniques to focus on movement between parts and the whole Suggests extensions to experience sampling techniques to understand interpretations based on changing contexts	Suggests that existing technologies may be altered or new technologies may be produced to reflect new consumer interpretations, as suggested by novel appropriations of technology	Suggests that designs echoing a particular existing medium can be drawn from to suggest similar interpretations of new media Suggests that existing media may be redesigned to capitalize on their reinterpretation in the ever-changing ecology of media

The circuit of culture provides the opportunity to describe lengthy and complex design cycles through the structure of the five cultural processes of representation, identity, production, consumption and regulation. Rhetorically, this theoretical base allows the relationship between production and consumption to come to the forefront, creating opportunities to see how producers and consumers both create new interpretations of technology. The articulation of five cultural processes also provides guidance to researchers who wish to more holistically study digital artifacts in the wild. For example, studying the appropriation of digital music technology without examining digital rights management (per the process of regulation) seems incomplete and naïve.

The circuit of culture also calls attention to a variety of stakeholders, those who reject technology in addition to those who buy, sell and regulate technology. These stakeholders provide starting points for responding to multiple interpretations through design. Methodologically, the emphasis on stakeholders also offers the potential of integrating the structures of the circuit of culture with complementary methods such as contextual design (Beyer & Holtzblatt, 1998).

The lens of media in remediation allows HCI researchers and designers to examine media as social phenomena and to unpack the reflexive interplay between new and old media in the interpretation and reinterpretation of technology. Rhetorically, remediation engages broad constructs in the shifting landscape of inter-related media and establishes the passage of time as a dominant dimension. It provides strong predictions regarding the inheritance of old media into new media and the reciprocal influence of new media on old media. From a design perspective, remediation offers guidance about borrowing metaphors from old media in the invention of new media and also counsels that in time, design efforts re-engaging older media may be productive.

Methodologically, remediation provides linguistic guidance for understanding interpretations of technology in interview data or the analysis of conversation, focusing attention on the use of retronyms or other allusions to

existing technologies or the conventions of existing technology use as evidence for interpretation.

CONCLUSION

In this chapter, I have argued that it is time for the field of HCI to pay heed to the multiple interpretability of technology. Throughout its history, the field of HCI has witnessed increased diversity in the users of technology, the activities supported by computation, and contexts in which technology has been used. HCI theory has progressively broadened to reflect these numerous forms of increased diversity in computer use. I argue that the time has come to endorse a larger theoretical landscape that embraces additional diversity—the diversity of interpretations of technology.

In this chapter, I have also presented three theories, each of which highlights different facets of the processes surrounding multiple interpretability. I have engaged each of these theories in light of the specific needs and goals of the HCI community and suggested the ways that a theoretical lens of multiple interpretability can both enrich existing HCI goals and methods and enable new research trajectories.

CHAPTER 3

EXPANDING HERMENEUTIC INQUIRY TO COMPUTATIONAL TECHNOLOGY

There are numerous theoretical “footholds” from a variety of disciplines such as cultural studies, media studies, science and technology studies, and philosophy that could provide HCI with a much-needed focus on the multiple interpretability of technology. In this research, I draw most centrally from the domain of hermeneutics for several reasons:

- Hermeneutics, unlike some other theories, acknowledges the roles of both the individual and the technological artifact in constructing meaning. This is essential, I believe, for achieving a balanced perspective of the interpretive process.
- Hermeneutics has an extensive and fundamentally interdisciplinary history. This is important to me as it allows for much flexibility to draw from other theories and literatures where there are resonances.
- Most importantly, hermeneutics engages the interpretive process from the perspective of the individual interpreter, a perspective and unit of analysis that most closely matches the style and priorities of the qualitative empirical work that I do and that is common within HCI.

Hermeneutics is “the science or art of interpretation” (Grondin, 1994) and explores “the most fundamental ways in which we perceive the world, think, and understand. It has a philosophical root in what we call *epistemology*—that is, the problem of how we come to know anything at all” (Jasper, 2004). Historically, questions about interpretation have centered on the interpretation of texts, particularly sacred texts. Postmodern hermeneutics, however, has expanded the application of hermeneutics, asserting, in some cases, universal applicability (Gadamer, 2005). In arguing for the extension

of hermeneutics to human action and the social sciences, in particular, Ricoeur proposed two criteria for establishing that a discipline may be said to be hermeneutical (1981). Based on these two criteria, the study of computational technology may be said to be hermeneutical: "(1) inasmuch as their *object* displays some of the features constitutive of a text as a text, and (2) inasmuch as their *methodology* develops the same kind of procedures as those of...text-interpretation" (Ricoeur, 1981).

HERMENEUTICAL CRITERIA: FEATURES OF THE OBJECT

Ricoeur outlines four features of text against which computational technology might be compared. These four features also serve to introduce some of the fundamental concerns of hermeneutics.

The Fixation of Meaning

Text is a fixed inscription of something more fleeting—namely, discourse, which is an event having to do with language; a conversation, for example. What is inscribed as text, however, is not the event itself, but the meaning of the event, an important distinction. The meaning of the event is broad and encompasses more than just the specific words to be inscribed. One aspect of the meaning of discourse is *that which is said*. Drawing from Ricoeur's example of an order to close the door, "when I tell you to close the door," that which is said is "Close the door!" (Ricoeur, 1981). But meaning also includes *that which we do in saying*, or the force of what is said. In Ricoeur's example, that could be the harsh force of an order or it could be the more subtle force of a request. In addition, meaning also includes *that which we do by saying*, or when we use discourse to elicit certain effects, such as fear elicited as a result of a very forceful order.

Each aspect of the meaning of discourse is codified using paradigms appropriate for text (e.g., grammatical modes and/or punctuation) and are inscribed or fixed. The fixation of discourse in text provides a level of objectification that is necessary for hermeneutical inquiry.

A technological artifact is also an embodiment of something that is fleeting—a design process. Many different aspects of this process are codified

according to paradigms that are appropriate for design and are fixed in the technological artifact: the functionality that is to be supported, the practices that are meant to be fostered, the emotional impact that the technology is meant to have, the meaning of the brand that is meant to be conveyed and so forth. The inscription of the design process in a technological artifact provides a level of objectification that also enables hermeneutical inquiry.

The Dissociation from Authorial Intention

The fixed nature of text allows the text to outlive its author. As a result, there is a dissociation between the intention of the author and the meaning of the text. Gadamer speaks of two worlds, in fact: the world in which the text was written and the world in which the text is engaged (2005). One can no longer ask the author of most texts what he or she meant; instead, one has to ask what the text means. Texts that have been around for centuries can be and are continually revisited and interrogated for what they mean in new contexts and for new audiences.

When a new technology is launched, it leaves the hands of its design team. It is used or not used. It is used both in ways that were envisioned by the design team as well as in ways that were not. In this, there is a dissociation of the technology from the intention of the design team. The dissociation of technology from the intention of the design team may be a tighter and more dialogic process than the dissociation of a more classical text from the intention of the author. Once a text in a traditional form (e.g., a published book) is inscribed, it is rarely and only periodically re-inscribed to account for new context or to address how the text was originally interpreted. In contrast, when technology is launched, some design teams observe how technology is used and, when unanticipated uses emerge, return to the design process to re-inscribe the technology and create new versions that address these emergent interpretations.

An example of this tight, dialogic process can be seen in the case of the Sony Walkman. The first version of the Sony Walkman contained sockets for two headphone jacks (du Gay, Hall, Janes, Mackay & Negus, 1997). Sony's initial marketing campaign included a commercial depicting two individuals sharing

a Walkman and listening to the same music. The design team's original interpretation of the Walkman was fundamentally social.

It was only after the Walkman was launched and being used that Morita [the co-founder of the Sony Corporation] observed that 'buyers began to see their little portable stereo sets as very personal.' As a result, the Walkman Mk2 was introduced as a machine with just one headphone jack socket (du Gay et al., 1997; see also Morita, Reingold & Shimomure, 1987).

Although the process of dissociation can be tighter and more dialogic with computational technology than with classical texts, the fundamental feature is the same: technological artifacts are launched and dissociated from the intention of the designer. Technology's dissociation from designer intention also enables hermeneutic inquiry.

The Display of Non-Ostensive References

Fleeting discourse references a particular world. In a conversation, for example, that world is the shared situation common to all conversants. Just as the inscription of text frees itself from the limits of its authorial intention, text also frees itself from the limits of its original situation, its ostensive reference. Instead, a text projects a new world, an "ensemble of references opened up by the text," including our own world and situation (Ricoeur, 1981).

Computational technology may also be said to display non-ostensive references if the meaning of a technology transcends the context of its production and develops relevance beyond its original situation. In many ways, the history of technology is a history of computational artifacts transcending their original situation and finding relevance in new contexts. The original computer was developed in a military context, used by scientists to calculate the trajectories of bombs. But the computer has also found great relevance in business contexts; and then in schools; and in homes, pockets and purses. Also originally developed in a military context, the Internet was used by scientists for communication and file sharing. The Internet is now

used for publishing home movies, selling used books, and pre-ordering pizza from the restaurant down the street. Technology's ability to transcend the context of its production—to display non-ostensive reference—also enables hermeneutic inquiry.

The Universal Range of Addresses

Discourse is addressed to someone—that person or persons who share in the situational context, the ostensive reference. But with text, this “dialogical relation explodes” (Ricoeur, 1981). The audience of text can be anyone who reads, anyone who picks up the text: “Instead of being addressed just to you, the second person, what is written is addressed to the audience that creates itself” (Ricoeur, 1981). An unseen and unknown audience is the addressee of text. And, indeed, the field of liberation hermeneutics has asserted that anyone who is impacted by others' interpretations of a text is also part of the audience and a stakeholder in the interpretive process (Gutierrez, 1988).

Similarly, the audience of computational technology has exploded since its inception. Anyone who uses computation—a desktop or laptop computer, a digital music player, a cellphone, for example—is an audience of computational technology. Even more broadly, people who do not personally use computers but who live in a social context replete with others' technologies—visiting coffee shops in which the social environment has been transformed by Wi-Fi hotspots, for example—are an audience for computational technology. And even more broadly, anyone beyond the physical scope of computation whose life is impacted by others' use of computation is also a member of the audience and stakeholder in the interpretive process.

In these ways, then, computational artifacts share the features of text that make it relevant for hermeneutic inquiry.

HERMENEUTICAL CRITERIA: AN INTERPRETIVE PROCESS

Ricoeur's second criterion for a discipline to be considered hermeneutical is that there are methodological procedures similar to those for text-

interpretation (1981). There is an interpretive process at play in reading and if technology is to be considered hermeneutical, there should be an interpretive process in the use of technology, as well.

One of the fundamental features of text that ensures that an interpretive process exists is that text consists of multiple layers. Text is not merely a list of words strung together, nor is it merely a list of sentences strung together. Not all parts of a text can be understood in isolation. Not all parts share equal importance. Parts must be understood in relation to the whole and the whole must be understood in relation to the parts. This relationship between the whole and the parts requires a certain kind of deciphering and circular interrogation (movement between understanding the parts and understanding the whole) that is an interpretive process and opens the text to multiple interpretations.

Ricoeur provides another way of viewing this same feature of text:

Still another way of expressing the same enigma is that as an individual the text may be reached from different sides. Like a cube, or a volume of space, the text presents a 'relief.' Its different topics are not at the same altitude. Therefore the reconstruction of the whole has a perspectivist aspect similar to that of perception. It is always possible to relate the same sentence in different ways to this or that sentence considered as the cornerstone of the text. A specific kind of onesided-ness is implied in the act of reading (Ricoeur, 1981).

The different sides from which one might read a text act as different vantage points from which different interpretations may emerge.

Technological artifacts have the same multilayeredness as text. Computational technology contains individual user interface components that combine to provide access to different features that combine to constitute the device, all of which combine to constitute a larger technical and socio-technical system. Just as interpreters of text must move between understanding the words, understanding sentences or paragraphs, and

understanding the whole of the text, so must people who use technology move circularly between understanding user interface elements, understanding features, and understanding the technology as a whole.

My iPod, for example, has a central button surrounded by a wheel, a display, a hold button (on the top), a dock connector, and a headphone jack. The central button and the wheel, when combined with software, constitute a "Click Wheel" that allows both for scrolling and volume control. The display can be used to provide menus and to display the current song. When I have a microphone plugged in, the display also becomes a timer for the length of interviews I may be conducting. Each of these interface elements combines to constitute features that then combine to constitute a digital music player or digital voice recorder. There are multiple possible interpretations of my iPod depending on which features and functions come into relief through use.

Based on criteria set forth by Ricoeur, then, technological artifacts can be said to support hermeneutic inquiry. Technological artifacts are fixed inscriptions of a fleeting process. When launched, they are dissociated from the intention of the designer and from the initial context. Technological artifacts display universal address. And finally, technological artifacts are multilayered, which requires a process of interpretation that moves between the whole and the constituent parts.

CAVEATS & CLARIFICATIONS

In arguing that hermeneutic inquiry encompasses the study of computational technology and, therefore, that technology is an interpreted artifact, I am not arguing for the arbitrariness of those interpretations. Not all interpretations are equally valid. Here, Schneiders provides an illustrative example:

We listen to Beethoven's "Fifth Symphony" over and over, played by different orchestras, both because it is always the same and because it is always different. Beethoven's "Fifth" cannot be played any way at all. If the rendition sounds like "Yankee Doodle Dandy" we dismiss it as invalid. On the other hand, if the rendition is a wooden reproduction of some other

performance we dismiss it as inadequate. In this sense all renditions should all sound alike, that is, they should each realize the ideal structure inscribed in the score, but every rendition should also be unique and original because of the interpretation by a particular conductor and orchestra (1999).

Conversely, I am also not arguing that there is one correct or optimal meaning toward which all valid meanings should ultimately converge. The extreme belief that the author's so-called intended meaning is the ground truth of meaning and the end-goal of interpretation has been repeatedly debunked within mainstream philosophy (e.g., Gadamer, 2005; Polanyi, 1998; Ricoeur, 1976; Wimsatt & Beardsley, 1954).

Sengers and Gaver have argued that the field of human-computer interaction has frequently held up the designer's intended meaning as ground truth in research and evaluation (2006). A stance that holds out for the identification or attainment of one ground-truth meaning is both untenable and undesirable. This stance is untenable because a text or a technology is already one step removed from the author's or designers' intended meaning. An intended meaning is an internal construction that must be translated into another medium, whether it be language or bits. A text or a technology will always be an approximation of the original intended meaning, which remains inaccessible (Polanyi, 1998). Jasper offers an example of this slippage between intention and meaning in Lewis Carroll's *Alice in Wonderland*:

"Then you should say what you mean," the March hare went on. "I do," Alice hastily replied; "at least—at least I mean what I say—that's the same thing, you know." "Not the same thing a bit!" said the Hatter. "Why you might just as well say that "I see what I eat" is the same thing as "I eat what I see!" (qtd. in Jasper, 2004)

In addition, one ground-truth intended meaning is also undesirable as much of the meaning of an interpreted artifact is only constructed with use:

Texts do not derive their meaning from their author's intention even though, in successful writing, it begins there. Rather, meaning arises in the interaction between texts and readers. Strictly speaking, texts do not "mean" any more than musical scores "sound." They present possibilities for meaning the way a score offers the possibility for making music in a certain way. Meaning is not *in* texts but mediated *by* texts (Schneiders, 1999).

Likewise, meaning is not in technology but is mediated by technology. Meaning arises through use.

Gadamer takes this argument one step further and distinguishes between an *art object* and a *work of art* (Gadamer, 2005). An art object is the physical artifact—the text, musical score, or technological artifact. The art object only becomes a work of art when it is being read, heard, or used. The work of art is "actualized in the act of appreciation" (Schneiders, 1999). It is in the act of being appropriated that technology takes on meaning, that the technological artifact becomes a work of art.

As a hermeneutical domain, then, the study of computational technology needs to better understand how it is that people interpret technology, the process through which technology takes on meaning.

RELATED WORK AT THE INTERSECTION OF HERMENEUTICS AND COMPUTATIONAL TECHNOLOGY

Grounded in a hermeneutic perspective, the goal of this research is to better understand how people interpret technology. Other research from a variety of disciplines has also drawn from hermeneutics to address related research goals surrounding the design and use of computational technology.

Early conversations among the HCI community wrestled with the apparent dichotomy between interpretive approaches to research and the need to enact design and develop a theory base in this relatively nascent discipline:

The limited scope of quantitative theories precludes adequate grounding for design decisions. Such theory-based design has

never occurred on a nontrivial scale. On the other hand, bridges from hermeneutic interpretation into design decision-making are essentially mystical. There is no systematic methodology, no conceptual framework, no explicit way to abstract from particular experiences (Carroll & Kellogg, 1989; see also Button & Dourish, 1996).

In response to this dichotomy, Carroll and Kellogg proposed a claims-based approach to bridge between the “idiosyncratically interpreted, specific instances” of hermeneutic insight and the “isolated theoretical abstraction” of theory-based design.

A somewhat disparate body of research within human-computer interaction and computer-supported cooperative work has drawn from hermeneutics in advocating for more flexible and appropriable design. This research, in general, highlights the multiple interpretability of technological artifacts and the role of the user in constructing the meaning of a technology. Chalmers suggests that collaborative filtering and path-based systems can be understood as examples of hermeneutic system design, supporting the “adaptation and appropriation of computational representations” (Chalmers, 2004). Computational reflection and open implementation have also been forwarded as technical means for supporting flexible appropriation and the active construction of meaning by users (Bentley & Dourish, 1995; Button & Dourish, 1996; Dourish, 1995). More recently, Sengers and Gaver have revitalized the dialogue about multiple interpretability within the HCI community, arguing further that attention must be paid to supporting flexible appropriation in design (Sengers & Gaver, 2006). Indeed, this recent line of argumentation has been considered part of the evidence for a new paradigm within HCI (Harrison, Tatar & Sengers, 2007).

Some researchers within the field of information systems have employed a hermeneutic perspective in their field studies of technology use, providing interpretive analyses of the organizational use of email, for example (Lee, 1994), or a centralized payroll system (Myers, 1994). Following early examples of the application of a hermeneutic perspective within information

systems research, Klein and Myers set about establishing a core set of principles for conducting and evaluating interpretive field studies in this domain (1999). They argue that hermeneutics, as an instance of an interpretive research paradigm, can support the following goals of the information systems research community:

- “help IS researchers to understand human thought and action in social and organizational contexts; [and]”
- “produce deep insights into information systems phenomena including the management of information systems and information systems development” (Klein & Myers, 1999).

Klein and Myers propose seven principles for interpretive field research, including the following:

- The fundamental principle of the hermeneutic circle suggests that data analysis must iterate between individual pieces of data and the “global context” that determines the full meaning of that data;
- The principle of contextualization suggests that the subject of investigation must be understood within its social and historical context and that individuals must be viewed as “producers and not just products of history”;
- The principle of interaction between the researcher(s) and the subjects suggests that that meaning is produced through the various interactions among researchers and participants;
- The principle of abstraction and generalization suggests that specific instances of phenomena should be articulated in terms of abstract categories or broader ideas and concepts;
- The principle of dialogical reasoning suggests that the researcher should make his or her own prejudices and philosophical assumptions explicit;
- The principle of multiple interpretations suggests that the researchers should explore the varying viewpoints of stakeholders and unpack any conflicting interpretations; and

- The principle of suspicion suggests that researchers should critically interrogate forms of “domination, asymmetry, and distorted communication” (1999).

In general, the field of information systems has applied hermeneutics as an interpretive approach to research. The socio-technical system that is the object of interpretive field studies is, then, the “text” that is “read” by researchers.

Information systems researchers who have adopted a hermeneutic perspective have argued that “interpretive researchers must recognize that the participants, just as much as the researcher, can be seen as interpreters and analysts” (Klein & Myers, 1999) and, further, that “information systems researchers need to dedicate attention to the actual processes by which the users of a [technology] come to understand themselves, their own use of the medium, and their organizational context” (Lee, 1994). In other words, interpretive researchers in information systems have argued that a better understanding of users’ interpretive processes is a critical next step. And, indeed, foregrounding, validating, and understanding these interpretive processes are the primary goals of this research.

POSTSCRIPT

The word *hermeneutics* has its linguistic origins in Greek mythology. Hermes was the messenger of the gods, charged with carrying their secrets and messages to the people of the earth: “With his winged sandals Hermes was able to bridge the gap between the divine and human realms, putting into words those mysteries which were beyond the capacity of human utterance” (Jasper, 2004). In the non-mythological world, one doesn’t exactly have a hermetic messenger, although one might come in awfully handy. I imagine many of us have sat confounded in front of new technology, wishing for a messenger to explain the mysteries of the technology—what the designer was thinking. Instead, one has to act as one’s own interpreter, understanding the nature of technology as it is encountered in one’s everyday experiences.

PART 2
AN EMPIRICAL BASIS FOR EXPLORING THE
INTERPRETATION OF COMPUTER-MEDIATED
MESSAGING SYSTEMS

CHAPTER 4

WHEN CONVENTIONS COLLIDE: THE TENSIONS OF INSTANT MESSAGING ATTRIBUTED

In this first study, conducted in early 2001, I wanted to understand what people were doing in the relatively new medium of instant messaging. In participants' use of instant messaging, I not only observed a diversity of practices, I found a diversity of communicative conventions and expectations about how the technology should be used. Data from this study suggested that individuals drew from multiple different media, for example written and verbal communication, when deriving conventions and expectations for this medium.

INTRODUCTION

Of late, there have been an increasing number of ethnographic and ethnographic-style studies of computer-mediated communication (e.g., Bradner, Kellogg & Erickson, 1999; Cherny, 1999; Erickson, 2000; Grinter & Eldridge, 2001; Mynatt, Adler, Ito, Linde & O'Day, 1999; Nardi, Whittaker & Bradner, 2000). In general, these studies aim to understand why people use the particular communication medium that they do, whether it be chat (Bradner, et al., 1999; Erickson, 2000), text messaging (sending text messages through mobile phones) (Grinter & Eldridge, 2001), instant messaging (Nardi et al., 2000) or otherwise (Cherny, 1999; Mynatt et al., 1999). These studies have identified some of the communication tasks that the medium supports. For example, Bradner et al. report that their novel chat system supports communication tasks such as waylaying other users and unobtrusively broadcasting information (1999); Grinter and Eldridge report that teenagers use text messaging for arranging times to chat and coordinating with friends (2001); Nardi et al. report that instant messaging in

the workplace supports communication by enabling users to hold intermittent conversations and manage conversational progress (Nardi et al., 2000).

And yet, for all the documented uses for and positive affordances of computer-mediated communication, there are consistent tensions with its use.

My goal for this study was to uncover any observable tensions in instant messaging, to understand why these tensions existed, and to discuss these tensions at a granularity that would provide concrete guidance to designers.

In this chapter, I posit that the majority of tensions in instant messaging stem from conflicts and ambiguity among the multiple, overlapping conventions of verbal and written communication. I then present a design space with design choices that emerge from the investigation of these conflicts.

METHOD

I studied the instant messaging use of 8 members of a university research lab over a two-week period. These lab members were often co-located during the day and worked on conceptually-related but different research projects. Data was collected via observations, interviews, and transcripts of instant messaging conversations. In general, observations led to interviews and data from the interviews led to the collection and analysis of instant messaging texts.

Instant messaging transcripts were shared on a voluntary basis over a period of two weeks. Some conversations were perceived as being too personal and were not shared for that reason; others were not shared by accident—the instant messaging window was sometimes habitually closed before the text was saved. Sixty-one transcripts were collected and analyzed. Of those, fourteen were of conversations between members of the lab and forty-seven were of conversations between lab members and individuals outside the lab. Some conversations took place while the lab member was in the lab; others, from the lab member's home. Some of the conversations were purely social,

some were work-related, and many were a mix of both. A total of 26 individuals were represented in the transcripts.

MEANING AND CONVENTIONS

I use instant messaging because it feels immediate, but I don't have to devote my immediate attention to it... I can ask people things...get responses right away. I can feel like I am having a conversation but I don't have to be restricted...to drop everything else just to have that conversation. I can do other stuff, too.

- Eric¹

This was a typical description of what instant messaging meant to the participants in this study. Participants were observed engaging in instant messaging with much the same breadth of goals and uses discussed in previous research (Bradner et al., 1999; Grinter & Eldridge, 2001; Nardi et al., 2000), but when it came down to articulating the value of the communication space, the discussion was almost always one level removed from specific tasks or goals. The value was found in broader-ranging affordances.

Listening to the language of the participants in the interviews led me to examine various conventions of instant messaging use. This focus on the conventions of use led me, in turn, to a reexamination of my data, looking at instant messaging as a hybrid genre—a niche somewhere between written communication and verbal communication.

The participant's description characterizes instant messaging as being nearly synchronous but able to be attended to when opportune. The former characteristic is shared with most verbal communication; the latter, with most written communication. Implied in the interviews of my participants is that instant messaging is valued because of the unique balance it holds in affordances between the conventions of verbal and written communication.

¹ Names of all participants as well as individuals mentioned in the instant messaging transcripts have been changed.

In his writing, Gunther Kress, a sociolinguist, describes some of the conventions of verbal communication (Kress, 1989). Kress' observations, where cited, have formed the skeleton for a brief comparison between the general conventions of written and verbal communication (Table 4.1). The interactions between the conventions provide the basis for the remainder of this paper—for characterizing the tensions evident within instant messaging texts.

Table 4.1 Comparison between the general conventions of verbal and written communication.

General Conventions of Verbal Communication	General Conventions of Written Communication
No persistent record of communication	Persistent record of communication
Hesitations and thinking on the spot without being considered inarticulate (Kress, 1989)	Crafted carefully and edited so as not to be perceived as inarticulate or illiterate
Synchronous	Asynchronous
Turn-taking by establishing "overt cohesive links within the text of the preceding speaker" (Kress, 1989)	Turn-taking explicitly granted through exchange of communicative artifact
Syntax of sequentially adjoined clause chains (Kress, 1989)	Syntax of hierarchical sentence structure (Kress, 1989)
Requires continuous attention	Attended to as circumstances allow
Situational context through shared audio or shared space	No situational context unless explicitly communicated in text
Availability communicated primarily through body language; the power in initiating communication lies with the initiator.	Availability is not an issue as communication is dealt with when opportune; the power in initiating communication lies with the receiver.

A Note on Sociolinguistics

This work is not the first application of sociolinguistics to computer-mediated communication (Bergquist & Ljungberg, 1999; Erickson, 2000; Yates & Sumner, 1997). Much of the existing work looks beyond the medium, to the conversation as unit of analysis. Although I strongly support this approach, I found the medium a more fruitful unit of analysis for this work. The tensions I examined were common across different types of conversations and the

design implications I want to provide would need to be useful at the broader interface level.

TENSIONS

When I analyzed instant messaging transcripts paying heed to conventions of use, textual tensions emerged as a result of the interacting conventions. Perhaps the flexible use afforded by these conventions also enacts ambiguity for users as to the conventions of instant messaging use.

In this work, I focus on the tensions of instant messaging, but I want to make it absolutely clear that overall, instant messaging works. That is to say, there is plenty of evidence of instant messaging use that does not give rise to these tensions. There are also an even greater number of instances when these tensions either do not undermine the users' communicative goals or are not noticeable to participants. The tensions reported in the remainder of this paper, however, all appeared in multiple transcripts and, given that some participants articulated clear frustration with these tensions, they seem to warrant discussion.

Here, I present five tensions, discuss how they can be attributed to interactions between conventions of verbal and written communication, and suggest initial implications for designers.

Persistence and Articulatensess Tensions

In the instant messaging texts, there were tensions evident between the transient nature of verbal communication and the persistence of written communication. Users appeared to treat conversation casually and informally as with verbal communication, not worrying about hesitations and not editing their language as they might in written communication. But when errors in grammar or spelling appeared visibly persistent on the screen, there seemed to be a need to foreground those errors, to make light of them, and to say in essence, "I see that error and want you to know I am not as illiterate as my typing may indicate." Often, too, the listeners responded back in the same light tone, perhaps acknowledging the lack of significance or seriousness that they ascribed to the error. The following three excerpts exemplify these

tensions between the transient nature of verbal communication and the care that is given to crafting written communication.

Jeff: There are so much bad design

Matt: no kidding

Matt: But I still get surprised sometimes

Jeff: And so much bad grammar

Matt: Bad grammar are everywhere

Eric: Maybe you could just get tow and they could
keep one another company

Eric: Er...that was supposed to be "two"

Eric: Later kiddop

Eric: =P

Katie: wrong your

Katie: darn

Katie: =P

Eric: (we're both batting 1000)

Design Implications

Tensions arise as a result of collisions between conventions of written and verbal communication. It is often ambiguous whether use of instant messaging aligns with conventions of written communication, verbal communication, or exists somewhere between the two. In resolving these tensions, it becomes the designer's responsibility to make choices about where the system will fall between the conventions and to provide support for upholding those conventions without stifling use through overdesign. A richer design space can be envisioned by exploring the interactions between multiple, conflicting axes of tensions. In the case of tensions arising from interactions between conventions of persistence and conventions of how formally the conversation must be crafted, design solutions may exist in any (and, indeed, may exist in all) of the four quadrants defined by these two axes (Figure 4.1).

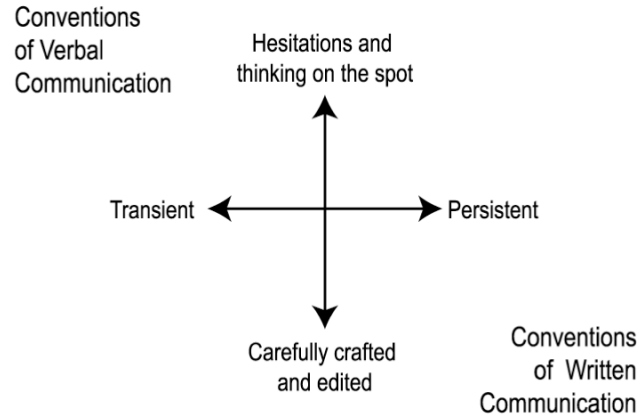


Figure 4.1 Design space for resolving persistence and articulateness tensions.

In identifying design examples and ideas, I am not making value judgments about the quality of the designs. Rather I aim to expose the breadth of the design space and catalyze further research in these areas.

Designs that focus on fostering persistence and thinking on the spot, for example, might identify ways of supporting short-hand or graffiti as modes of communication. Designs situated to support persistence and careful crafting of language might allow text to be edited after it was posted. Designs situated here might also explore the integration of spell-checking or grammar checking, on a passive or active basis. Designs that hone in on the careful crafting of a transient text might explore text fading or displays limited to only the most recent statements while maintaining a history that could be referenced if needed. A system design fostering more informal crafting of communication might work similarly but not maintain a history of the conversation.

Synchronicity Tensions

In the instant messaging texts, there was evidence of tension arising from the near-synchronicity of instant messaging, a characteristic shared with verbal communication, and users' desire to make the interaction feel asynchronous, as with written communication. One participant indicated quite resolutely that instant messaging "gets boring" when waiting for someone's response to be typed in. For this reason, unless she was already

engaged elsewhere and could multitask, she refused to maintain only one thread of conversation at once. Whether conscious or not, maintaining multiple threads of conversation in an instant messaging conversation was extremely commonplace. Of the following two excerpts, the first highlights the obvious confusion that can result from trying to follow multiple threads of conversation as Eric finally gives up.

Eric: Kitties don't like traveling in airplanes
Katie: they let you bring them on the plane
Eric: (Well, for that matter, neither do fish)
Katie: no?
Katie: they still alive?
Eric: One is
Eric: But I want to see you teach a cat how to pop
its ears
Eric: That would warrant a Nobel prize, at the very
least
Katie: true true
Katie: I want this cat at the store...it's like two
years old, but it's the coolest cat ever
Eric: Cool how?
Katie: Totally friendly...ready to cuddle and love ya
Katie: if it's still there in a couple weeks I'm
gonna see about getting it
Eric: Cool
Katie: ya know, animals can pop their ears
Katie: cats, dogs, hamsters
Katie: stacy and I agree
Eric: Huh

The tensions between the synchronicity of verbal communication and the asynchronous nature of written communication also contribute to missed comments in instant messaging texts; it may be the case that users do not successfully track multiple threads or that users were too busy typing when the comment appeared. Regardless, some comments were significant enough that participants had to explicitly reiterate a previous comment to return the conversation to a salient issue. In the following example, note Katie's early

comment about borrowing skis and her later reiteration of this point that she felt had particular significance.

Katie: tim and I went the weekend before last
Eric: Tim? Dalton?
Katie: I borrowed Kathy's skis
Katie: yeah
Eric: That's so cool!!
Katie: it was great!
Eric: Yeah, I bet! Did you ski Snowbowl, then?
Katie: no...not experienced enough yet
Eric: Where'd you go?
Katie: oh...I thought you meant the Snowbowl
Katie: yeah, we went up the hill
Eric: Just not the actual run named "Snowbowl"
Katie: yeah...that's the biggass black diamond I guess
Eric: No thanks, says me
Katie: exactly
Katie: so Kathy left her skiis with me so I can go up there again...she's probably never gonna use them again

Design Implications

With only one convention single-handedly causing the tension here, the design space can be defined by the single continuum between the synchronous nature of verbal communication and the asynchronous nature of written communication.

That instant messaging supports near-synchronicity—circumstances in which a single thread of communication is feasible—but that users are willing to endure confusion to engage in multithreaded conversations is a telling design lesson. Research exists that explores potential support for multithreaded communication. Smith, Cadiz and Burkhalter have synthesized elements of threaded, asynchronous chats with goal-driven chat conversations, structuring threads into conversation trees (2000). Designers might embody the lessons of this tension through interfaces that allow users to proactively

initiate, terminate, and differentiate between multiple threads in conversation. Among the other strategies of the designer, this might be explored spatially or iconically. Threads might also be annotated to denote the state of that portion of the conversation: 'finished,' 'come back to this thread,' 'ask so-and-so about this later,' etc.

Turn-Taking and Syntax Tensions

In the instant messaging texts, tension arose from interactions between turn-taking and syntax conventions. Users were not able to rely upon an exchange of the communicative artifact to structure turn-taking, as in written communication, because both users were able to contribute to the conversation at the same time. The listener could also not make overt links within the speaker's text to claim a turn, as in verbal communication. Compounding these issues, it was rarely apparent in transcripts whether the speaker intended one statement to be a complete series of phrases, as in verbal communication, or whether a statement was to act as a thesis to further elaboration, as in written communication. A complete series of phrases would imply to the listener that it would be an appropriate time to talk; a thesis to further elaboration would imply to the listener that there would be more text to read.

In the following excerpt, there were no clear roles of speaker and listener—both individuals were typing at once. Neither of the conversants was able to convey through syntax or turn-taking conventions when their turn was over. As a result, continuations of a thought were interrupted and that interruption was interpreted as an attempt to end the conversation.

Jen: Sigh...no more news on Donna from dad.
Grace: Have you heard any more from your dad? I do not have any mail from Diane. You just answered my question.
Grace: Do you know a game called Spider. It is a type of Solitaire. Laura says she likes it.
Jen: Go get your shower and get to bed...I hope your stomach calms down soon.
Jen: Haven't heard of Spider.

Grace: Thank you. I will be anxious to hear from you tomorrow. Good night and thanks again for the dinner.

Design Implications

The design space for resolving this tension is constructed by crossing the axes associated with the conventions of turn-taking and syntax (Figure 4.2).

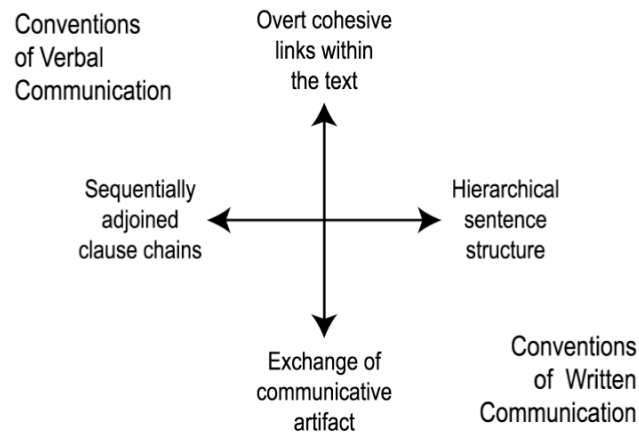


Figure 4.2 Design space for resolving turn-taking and syntax tensions.

Design solutions that provide overt cues that a conversant is claiming a turn include awareness cues such as the textual 'someone is typing' indicator in Microsoft Messenger™ and the auditory typing cues used in Babble (Erickson, Smith, Kellogg, Laff, Richards & Bradner, 1999). At a much less ambient level, this tension also might be addressed by further work in the area of Vronay, Smith and Drucker's status client (1999), which allowed users to see what was currently being typed by other users, or by visualizations supporting turn negotiation such as in Fugue (Shankar, VanKleek, Vicente & Smith, 2000). Design solutions that provide overt cues that a conversant wants to take a turn, before they actually do, might be explored as well.

On the other end of the turn-taking axis, design solutions might include preventing more than one conversant from typing at any given time.

Design solutions along the syntax axis might involve allowing users to convey the state of their thoughts along with their text, communicating both what

they wanted to say and whether each thought is a complete series of phrases, as in verbal communication, or about to be elaborated upon, as in written communication.

Attention and Context Tensions

There appear tensions, as well, between the amounts of attentiveness appropriate for instant messaging—a significant amount in verbal communication but a limited amount in written communication—and between the serendipitous context prevalent in verbal communication but missing in written communication. As indicated previously, one of the participants liked instant messaging because, in his words, “I can feel like I am having a conversation but I don’t have to be restricted...to drop everything else just to have that conversation.” Participants frequently multitasked while instant messaging. Other work was being accomplished. Other conversations were being held. Other information was being attended to. Participants explained that they liked instant messaging because they did not feel they had to attend and respond right away.

Even so, there was a particularly prevalent need for users to justify their absence or lag in responsiveness to each other. This justification commonly provided situational context that would likely have been evident in a verbal communication and unnecessary in written communication, but it also served as a preemptive repair tactic, leading the listener away from ascribing an interpretation of rudeness to the delay.

Jeff: Yo, are you there?
Jeff: I'm trying to send you the file
Adam: Yep, sorry - phone call.
Jeff: No problem

In the next example, context was communicated as parenthetical side notes resembling stage cues, giving the listener an idea of the attention distractor and justifying the lag in response.

Neil: just wish i had time to read more which reminds me, have you read George R R Martin's Game of Thrones series? If not you have to read them, best fantasy series since LotR imho

Anick: hm...I have not (jotting down title to dusty reading wish list)

Occasionally, individuals had differing expectations about how much and how frequently that attention should be paid. Without contextual evidence of what else is going on or how much time to expect their listener's attention to be diverted, an instant messaging conversation can completely fall apart. In the following excerpt, many of the lines were transmitted after a significant interval of time had passed.

Jake: Hey there
[pause²]

Loren: I'm here

Loren: sec
[pause]

Loren: hi honey

Loren: sorry, there were a bunch of people here talking to me
[pause]

Loren: are you there?

Jake: I'm here...was reading email on my laptop

Loren: so it should be interesting to talk to Ken tomorrow
[pause]

Jake: talking with Karen...sorry for delay in not talking

Loren: apparently we'll be talking about the media stuff

Loren: k
[pause]

Loren: honey, I think I'm going to head home right now...can we talk later?
[pause]

Loren: I guess you

Loren: are still talking with Karen (say hi to her)...so I'll get going now...

Loren: I love you

² I regret that I am not able to provide exact lengths of these pauses. This transcript was captured from an instant messaging client without time stamp functionality.

Design Implications

The design space for resolving this tension is constructed by crossing, as axes, conventions of attention and context (Figure 4.3). Most of the research and design in this area has been focused across the context axis. Regardless of the intent of designers to this point, users have felt socially compelled either to convey the illusion that instant messaging has their full attention or to offer justifications and preemptive repair tactics. But, as with tensions of synchronicity, users stage workarounds to try to avoid giving a conversation their full attention.

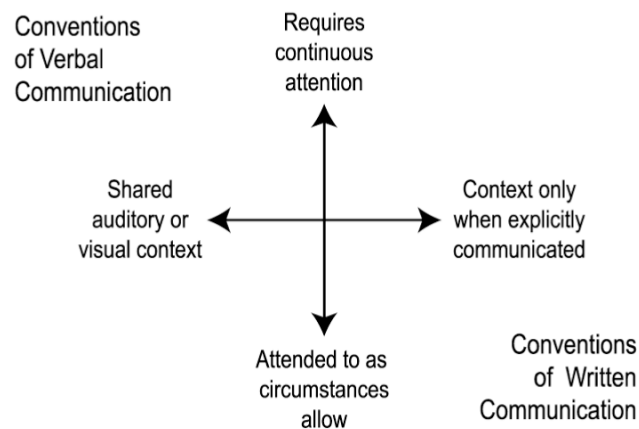


Figure 4.3 Design space for resolving attention and context tensions.

To counter tensions of attention, designers might explore systems that share abstract representations of context and attention, drawn from the conventions of verbal communication. These might be dynamic visualizations, such as the Babble 'cookie' (Erickson et al., 1999). They might be dynamic textual or iconic cues about input device idle time or other computer-mediated communication activities, such as found in ConNexus (Tang, Yankelovich, Begole, VanKleek, Li & Bhalodia, 2001). Cues of activity might also be explored with personal dynamic fonts such as Gromala's BioMorphic Typography (Bolter & Gromala, 2005).

Designers might also explore systems that allow users to share explicit indicators of context, drawn from the conventions of written communication.

This might involve providing status options that focus on the grey areas of attention as opposed to the black and white availability indications of 'Away' and 'Online' and implying more interest in interacting than is communicated by 'Busy' (i.e. 'Juggling a million things right now, please be patient').

These strategies are certainly not exclusive and there is likely much interesting research in exploring optimal combinations of these cues. There also continues to be a wide-open design space for research in how to foreground the conventions of opportune attention toward which users are straining.

Availability and Context Tensions

A final tension, similar to tensions of attention and context, also existed in the transcripts between the nature of verbal communication, which often foregrounds body language as an indicator of availability, and between the nature of written communication, in which the initiator of communication has little to no influence over when the communication will be dealt with. Instead of adding tension after a conversation has begun, as in the attention and context tensions, the tension here occurs in trying to initiate the conversation.

If the initiating conversational party had no access to serendipitous context or body language and the receiving conversational party was not available for communication, then a conflict occurred. But there were also conflicts even when the receiving party was available, because the initiator felt obliged to confirm the context that was otherwise missing. All participants, in one form or another, had to find explicit workarounds to manage their availability and to communicate context regarding their availability. This management took two forms: textual management and identity management. The next two excerpts illustrate textual management of availability. In the first excerpt, the initiating party felt obligated to ask explicit permission to communicate.

Jake: Busy?
Anick: no. not at all.

In the next excerpt, the explicit asking for and granting of permission to talk had become so ritualized that it was something to poke fun at.

Anick: hey Jake. You there?
Jake: I'm here
Jake: you?
Anick: I'm here too.

The second form of managing context and availability was through online identity. Participants structured their use of online identities and instant messaging clients to organize their acquaintances into social clusters (Figure 4.4).

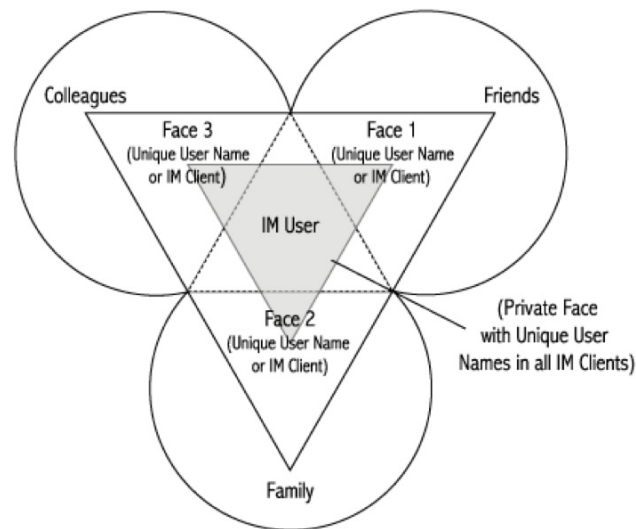


Figure 4.4 Management of availability and context through online identity.

Each of these groups (e.g. friends, colleagues, or family) was reachable through a separate user name or client. Conversely, participants were accessible to these different groups through separate user names or clients. Participants also maintained a 'private face,' an anonymous identity that could be used to lurk, to watch others without being seen. Participants could explicitly control which user names or clients were logged on at any given time—given who they wanted to reach and to whom they wanted to be accessible.

I use MSM for work because it was introduced to me by a lab member...and he got all the rest of the lab on it as well. Of course, it logs in anyway, but I always have it up when I am working...and those annoyingly big reminders help remind me who I need to talk to...so that's why I have work people on it.

ICQ was my first chat client. It's primarily old friends from back home...and I have my ICQ number on my old web page, so friends can find me that way. It logs on automatically, too, but it lets you pick your status and set a reason...I normally take the time to set it to 'Do Not Disturb' and tell them why so they won't bug me.

- Helen

Design Implications

The design space for resolving tensions of availability and context motivates a design solution along two axes: (1) between availability indicated through body language, where the power lies with the initiator, and availability that is dealt with when opportune, when the power lies with the receiver, and (2) between serendipitously and explicitly shared context (Figure 4.5). This design space shares a context axis with tensions of attention and context, but the context that is appropriate for alleviating the two tensions is of a different tenor.

Existing research in the area primarily populates the quadrant giving power to the receiver to provide explicit context and to deal with the communication when opportune. Vronay and Farnham's blob UI (1994) explored visualizations of the contact list, such as the intensional netWORKs of Nardi, Whittaker & Schwarz (2000). Further work might allow users to set rules for availability based on context and a contact's spatial location in the network. Such a design might allow users to manage only one client and identity.

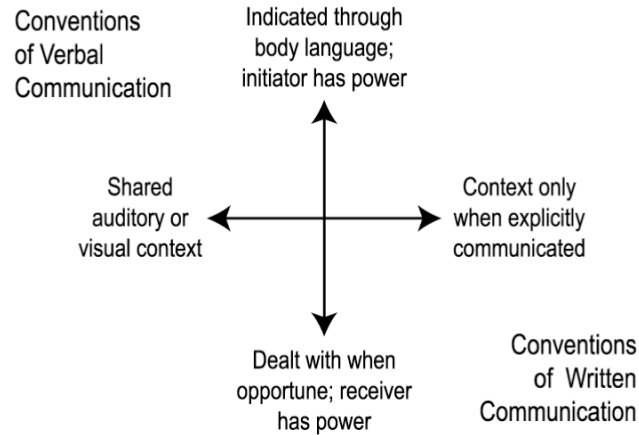


Figure 4.5 Design space for resolving availability and context tensions.

Further research might explore how the availability and context conventions of verbal communication might play a role in resolving these tensions, as well.

THE RESOLUTION OF TENSIONS

When conventions collide, tensions emerge. There are two ways one can imagine resolving these tensions—through the emergence of new conventions or through design scaffolding. Conventions emerge through communities of use. They emerge when expectations and patterns of use are visible to all. In communities of computer-mediated communication, conventions spread through shared use and legitimate peripheral participation (Lave & Wenger, 1991). Chat, newsgroups, and MUDs all function as online communities and have the ability to establish conventions through shared use. For example, in the SeniorNet network community, members socially developed conventions for the expected rhythm, the typical turn around time for a response, in various communication channels. Members nurtured these conventions via queries and admonitions when deviations occurred, and through peripheral learning by newcomers lurking on the channels (Mynatt et al., 1999).

Instant messaging is different. Instant messaging does not function as a community in the same way. The user is never privy to how others act or communicate. Conventions arise much more slowly, if at all, because there is

no shared forum for establishing them—just millions of users engaging in small, private conversations, each with their own flavor of conventions. And so I return to design scaffolding as the most likely venue for resolving the tensions of instant messaging.

CONCLUSION

Through analysis of instant messaging texts, I have identified the following tensions in the use of instant messaging:

- Persistence and Articulateness Tensions
- Synchronicity Tensions
- Turn-taking and Syntax Tensions
- Attention and Context Tensions
- Availability and Context Tensions

I have attributed these tensions to the conflicting interaction between existing communicative conventions. I have proposed a design space for exploring many potential resolutions to these tensions.

In this research on instant messaging, I have modeled an analysis technique that may be of use to designers working with other forms of computer-mediated communication—an analysis technique that looks to the interactions between communicative conventions to identify tensions, explain why the tensions have arisen, map the axes of the design space, and guide designers to design resolutions.

CHAPTER 5

THE MEANING OF INSTANT MESSAGING

In my second study of instant messaging, I wanted to better understand people's perceptions of the flexibility of the medium. Data from this study suggested that individuals ascribed a diversity of meanings to instant messaging—from an efficient and immediate medium to a medium that allowed users to be humorous, playful, comforted, intimate, and even idiosyncratic.

INTRODUCTION

The most common perspectives on instant messaging are relatively “objective” perspectives of character and function. A character perspective on instant messaging looks at properties of instant messaging use, such as frequency and duration, media switching, multitasking, or the rhythms of use (e.g., Isaacs, Walendowski, Whittaker, Schiano & Kamm, 2002; Nardi, Whittaker & Bradner, 2000). A functional perspective on instant messaging looks at the tasks supported by instant messaging—simple/quick questions or coordination and scheduling, for example (e.g., Isaacs et al., 2002; Nardi et al., 2000)¹.

A character perspective asks “what does instant messaging use look like?” and a functional perspective asks “what is instant messaging used for?” In contrast, I am asking “what is it like to use instant messaging?” or perhaps even “what is the meaning of the medium to its users?” In contrast to the character or functional perspectives, these latter questions may be viewed as indicative of a phenomenal perspective.

¹ Additional research on instant messaging has been framed by the conventions of the medium (Vaida, Newstetter & Mynatt, 2002) and social affordances of the medium (Bradner, 2001).

The phenomenal distinction is one that was made originally by Kant and subsequently by many other philosophers, notably Husserl and Heidegger. The world as we experience it, according to Kant, is the “phenomenal world.” Instant messaging, as we experience it, then, is “phenomenal instant messaging.” To take a phenomenal perspective on the study of technology is to study through the lens of the world as we experience it, as opposed to an “objective” view of the world². For example:

If a red traffic light makes you feel impatient...that feeling of impatience is part of how you experience the light, not a separate thing from it. This is true regardless of what the actual red light is doing. Say, for example, that you’re so impatient that you start banging your head on the steering wheel. Meanwhile, the light turns green without your realizing it. Even though the red light is gone, you still have the idea of a red light in your mind, making you bang your head on the steering wheel (Stevenson, 2002).

It is your experience of the light that triggers this reaction, not the light itself.

The application of phenomenology to human-computer interaction and computer-supported cooperative work is not new (see, for example, Dourish, 2001; Winograd & Flores, 1986). In addition, research that is conducted in the ethnomethodological tradition (e.g., Suchman, 1987) can be traced back through Garfinkel (1967) to its phenomenological roots.

Glimpses into a phenomenal perspective on instant messaging can be found interspersed throughout research by Nardi et al. (2000). While this research is primarily presented through a functional lens, various qualitative descriptions and quotes of participants offer glimpses into what instant messaging means to participants, for example, “[with instant messaging] you can be more quirky” or “IM injected playfulness and intimacy.” A more

² I use the word “objective” here in an appeal to our readers’ likely intuitions about the word. From the phenomenological perspective, however, objectivity cannot be divorced from subjectivity, as subjectivity is said to be “inextricably involved in the process of constituting objectivity” (Moran, 2000).

comprehensive study of instant messaging from this phenomenal perspective, however, is missing from the computer-mediated communication literature.

METHOD

As a first step in exploring instant messaging from a phenomenal perspective, I conducted a diary study. The diary study contained 3 multiple choice and 5 multiple response questions and was designed to take approximately one minute to complete. Twenty-two (22) individuals participated in the diary study; the subjects were drawn from a large computer science department in the research division of a large corporation. When the participants closed a messaging window, my diary study software prompted them to take a short web-based survey. This software allowed me to gain a users' perspective on the instant messaging experience in the local moment of the instant message.

Diary study participants completed a survey for each messaging window that was closed over the course of an entire day or a minimum of 10 instant messages, whichever came later. For those individuals who engaged in more than 10 instant messages over the course of the day, 10 survey responses were randomly selected for analysis in this study, for a total of 220 diary study responses. In the diary study, I asked the participants to tell me what the medium meant to the interaction—what instant messaging allowed or caused them to be. I also asked participants to indicate the function(s) of the instant message.

The response categories provided for the functional question were drawn from categories in previous literature (Isaacs et al., 2002; Nardi et al., 2000). The categories used for the phenomenal question originated from a short list extracted from descriptive language in the Nardi et al. study (2000). This language was then augmented by open-ended responses provided by a pilot group of 6 participants over the course of one work week. The categories were further augmented to mitigate bias in two areas—I felt that there were too few negative categories and too few categories that might reflect the point of view of one who did not initiate the interaction.

RESULTS

From a more “objective” perspective, one might draw from the “objective” affordances of instant messaging (e.g., near-synchronicity) and hypothesize that instant messaging allowed users to be immediate or efficient. From a phenomenal perspective, the meaning of instant messaging is more multifaceted. Out of the 220 diary study surveys, some responses were not at all surprising—instant messaging did allow users to be efficient (38%) and immediate (33%). But instant messaging also allowed users to be humorous (17%), playful (14%), comforted (9%), intimate (8%), and even idiosyncratic (4%).

Perhaps even more striking, however, is the extent to which these meanings of instant messaging were reported across participants. While it is again, perhaps, unsurprising that in at least one of ten diary study responses 91% of participants said that instant messaging allowed them to be immediate and 73% of participants said that instant messaging allowed them to be efficient, it is of note that 64% of participants said that instant messaging, in at least one of ten instances, allowed them to be humorous; 55%, to be opportunistic; 55%, to be playful; 45%, to be intimate; 41%, to be distracted; and 36%, to be comforted.

It might be tempting to dismiss meanings like playful as being only associated with social talk or meanings like efficient as being only associated with work-related discussions, but my data provide evidence to the contrary. Although efficiency and immediacy were the most frequent meanings of instant messaging reported in work-related discussions (56% and 40%, respectively), in 11% of work-related discussions, participants reported that instant messaging allowed them to be comforted. In 10% of work-related discussions, instant messaging supported humor. In 10% of work-related discussions, instant messaging supported playfulness. Instant messaging enabled more than just efficiency in work-related discussions.

Similarly, although humor and playfulness were the most frequent meanings of instant messaging reported in social talk instant messages (52% and 44%, respectively), in 21% of social talk, participants reported that instant

messaging allowed them to be efficient. In 21% of social talk, instant messaging supported immediacy.

Other meanings of instant messaging were equally prevalent in both work and social conversational contexts. The ability to have a change of pace and to vent, for example, was similarly common (3-4 responses) in both work-related discussions and social talk.

DISCUSSION

Instant messaging allows users not only to be immediate and efficient; it allows users to be playful and idiosyncratic, humorous and intimate. This was not the result of a few select users being playful or a few other select users being humorous. Instant messaging allowed a majority of participants to be humorous, opportunistic, playful and intimate at one time or another. In addition, these meanings of instant messaging were not just found in social conversations. Participants found that instant messaging allowed them to be humorous and comforted in work-related discussions, as well. Playfulness, idiosyncrasy, and comfort are just some of the many ways that users experience instant messaging.

As a research community, we have learned to document the affordances of a medium; we have come to document and characterize the types of work accomplished within a medium. But we have not, in general, come to study what is experienced within a medium. A richer portrait of a medium may be painted by augmenting a functional and character perspective with a phenomenal perspective.

Without an understanding of phenomenal instant messaging, the relationship between the experiential meaning of the medium and the features that support the experiential meaning are largely not understood. And without an understanding of those features, designers' abilities to augment or change the design of instant messaging clients are impeded. After all, how does one know what subtle changes might ruin the meaning of instant messaging for its users?

This study represents the start of a research programme aimed at exploring the phenomenal medium—the experiential meaning of instant messaging.

CHAPTER 6

SIX THEMES OF THE COMMUNICATIVE APPROPRIATION OF PHOTOGRAPHIC IMAGES

Around 2002, I became aware of studies of the use of multimedia messaging in Europe. I was intrigued to see the same sort of informal communication practices that I had observed in instant messaging at play within a visual medium. I wanted to better understand how digital photographs were used in communicative contexts. Because multimedia messaging had not yet been widely adopted in the US, I designed a new technology to explore the communicative uses of digital photography within instant messaging. Data collected from the use of this new photo-enhanced instant messaging client suggested that there were a diversity of appropriations of this new medium and that there were a wide variety of sources that might be drawn from in making sense of this new technology.

INTRODUCTION

The cultural history of visual communication provides rich evidence for the significance of the image in communication. Before the written word, in fact, was the image—evidence of communication found in the cave paintings of Lascaux predates evidence of early writing by as much as 10,000 years (Meggs, 1998). Since then, visual communication has flourished across time and culture, from the cave paintings of Lascaux to instruction booklets found in airline seat-back pockets and from coffin vignettes found on Egyptian tombs to last Sunday's comics (Meggs, 1998; McCloud, 1993).

Recent technologies ("recent" always being relative, but particularly on this scale) such as webcams, networked digital cameras and cameraphones allow users to overcome the traditional constraints of time and space in visual communication. Initial studies of networked digital camera use demonstrate

that new technologies such as these can change the way individuals think about photos, from images as memory support to images as expression (Mäkelä, Giller, Tscheligi & Sefelin, 2000).

Using these recent technologies, my research aims to further explore the use and impact of networked digital photography for visual communication. As with other new forms of communication (e.g., text messaging), the lower the cost of communication, the more freely the new communicative conventions and practices are explored and adopted (Grinter & Eldridge, 2001). To explore the potential of the photograph as visual communication, I have initially turned to a communicative medium in which the use of photos will incur little to no additional cost and that is already viewed as a flexible medium (Nardi, Whittaker & Bradner, 2000) and a medium of mixed modes and conventions (Volda, Newstetter & Mynatt, 2002)—instant messaging.

In this chapter, I describe the Lascaux instant messaging client, my platform for studying visual communication with digital photographs. Then, I give an overview of my methods and present the primary contribution of this paper—six themes of the communicative appropriation of photographic images. I describe each theme through examples from both external contexts as well as from the context of the Lascaux data. For each theme, I explore the ways a medium might be designed to better support each of these categories of communicative appropriation. Finally, I draw some broader implications about the relationship between literacy, mastery and appropriation for the design of computer-mediated communication media.

LASCAUX

I have developed and deployed an instant messaging (IM) client, Lascaux, in which users are able to take still photos from a live webcam feed and insert them inline into an instant message as easily as they are able to insert text (Figure 6.1)¹. Lascaux users see their own live webcam feed at the bottom of

¹ After data was collected for this research, Apple released a new version of its iChat instant messaging client (<http://www.apple.com/macosx/features/ichat.html>, accessed 5 May 2008) that supports similar live photo sharing functionality. The logging features of Lascaux allow me to study emergent communicative practices that are only likely to become more commonplace with a commercially available client.

the chat window and can click a "Send Photo" button at any time to capture and send the image.



Figure 6.1 Lascaux, an instant messaging client that serves as a platform for studying visual communication.

Lascaux is written in Java and implements a custom version of the MSN Messenger Service Protocol that allows Lascaux users to instant message with other MSN Messenger users. This design choice lessened critical mass-related adoption hurdles, both by allowing users to maintain the same number of IM contacts as previously and by enabling the additional functionality of Lascaux to be seen as compelling even if the other instant

messaging user was not using Lascaux—photos are automatically sent from a Lascaux client to a MSN Messenger client as attachments.

Lascaux implements two kinds of data logging: statistical logging and IM content logging. The statistical logs report the participants' anonymized user IDs and client-types as well as whether each line of the message was text or image. IM content logs preserve all text and images of the instant message, as seen by the coparticipants. When the Lascaux user closes an IM window, she is asked whether she would be willing to share the instant message with the researcher. If she says "yes," then both statistical logs and content logs are emailed to a researcher. If she says "no," then only a statistical log is sent.

Lascaux has thus far been used by 8 self-selected participants over the course of 4 months, with 22 total individuals represented in the log data (as Lascaux users also instant messaged with MSN Messenger users). 202 logs of Lascaux-to-Lascaux or Lascaux-to-MSN Messenger use were collected. A log of Lascaux use was defined based on when the participants opted to close a session window. Of those 202 Lascaux logs, 120 utilized images in their communication². A total of 806 images were shared.

In general, a Lascaux encounter emphasized the image as a first-class communicative object. In the context of instant messaging, I observed an experimental, fluid, coparticipatory interleaving of text and image where, in some cases, the image carried the communicative weight of the instant message. In a representative excerpt³, one can see how text and image interleave, with images occasionally catalyzing conversational threads:

```
Jimpy:  hey boss  
Jimpy  new changes?
```

² These numbers reflect the number of logs received, not the number of unique instant messages that occurred, since in Lascaux-to-Lascaux instant messages, both parties submitted logs. There is not, however, a one-to-one correspondence that would make for a simple quantitative characterization, as Lascaux coparticipants would often close their instant messaging window and send the log at multiple and differing points over the course of an instant message. If I had to estimate, I would speculate the number of unique messages to be about 75% of the number of logs received.

³ In all excerpts, identifying information in the text has been anonymized but idiosyncrasies of language and typographic errors have been preserved. All images are presented unaltered, with the participants' consent.

Scott: Hiya
[...]

Scott: I'm gonna check the email logging stuff in momentarily...just popped back on to test it out

Jimpy:



Scott: Dude, you've got the best cheezy response pics

Scott:



[...]

Scott: you da man

Jimpy:



Scott: k

Scott: see ya

Scott:



Jimmy:



One can see how images from one conversant interleave with images from the other conversant. Some images appear highly posed while others appear more natural. Images convey reactions. Images illustrate textually-conveyed expressions. Images replace traditionally textually-conveyed expressions. One can see experimentation with perspective in the pointing image and experimentation with movement in the waving image. One can see visual “goodbye” rituals taking hold. The use of Lascaux spanned work and home environments; a single Lascaux interaction often included both work-related and social communicative functions.

Method of Analysis

I began by analyzing the data using inductive or open coding (Bernard, 2000), allowing themes of use to emerge from the data. It became clear that there were many ways images were being used to communicate, but I found that: (1) the level of abstraction of my initial analysis was too low for developing what I felt would be useful and generalizable design implications and (2) there were uses for images that were not as prevalent in this data as they were in other related work and I wanted to better understand why. In parallel with continued analysis of the Lascaux data, I began analyzing the communicative use of images in other contexts—from other contexts within HCI, such as media spaces, to contexts more traditionally associated with disciplines like visual studies or the history of graphic design. In general, my analysis emphasized the construction and authorship of images, in contrast to an emphasis on the interpretation of images that is more typical of the visual studies discipline.

By examining the communicative appropriation of images in other contexts and in the Lascaux data, I found that:

- attempting to bridge the sometimes large conceptual gap between the Lascaux data and the use of images in other contexts helped me focus on themes at a higher level of abstraction, resulting in what seem to be more generalizable design implications;
- reflecting on instances of themes in visual communication outside the context of the Lascaux data enabled me to better distinguish general themes in communication from more specific influences of the IM medium or the Lascaux deployment on these themes; and
- observing evidence of themes in visual communication in other contexts but absent in the Lascaux data allowed me to question what about the Lascaux medium or its deployment might have precluded such appropriation, allowing me to generate additional design implications.

Emergent themes from the Lascaux data were refined based on emergent themes from image use in contexts outside of the Lascaux data and vice versa until the themes converged. The six themes presented here are the result of this combined method of analysis.

SIX THEMES OF THE COMMUNICATIVE APPROPRIATION OF PHOTOGRAPHIC IMAGES

Six themes of the communicative appropriation of photographic images emerged from my analysis⁴:

- the image as amplification,
- the image as narrative,
- the image as awareness,
- the image as local expression,
- the image as invitation, and
- the image as object/instrument.

⁴ Because my analysis was tightly coupled with the use data of American participants, the themes may reflect a Western bias.

These themes do not constitute a framework in the traditional sense of the word; they are neither mutually exclusive nor at quite the same level of abstraction. They are, however, themes that I encountered repeatedly in my analysis and found most useful in understanding the breadth of the Lascaux data. I present the themes here in generally increasing order of their degree of sociality. I consider the themes to be predictive (although subject to the influence of particular media), due to their constancy across contexts, as well as provocative, due to their perspective that extends beyond the traditional bounds of computer-mediated communication. The purpose of the themes is equally to inspire and to forecast the emerging space of computer-mediated visual communication.

Likewise, the goal of my design implications is not to provide a set of specifications for the next version of an instant messaging client. Indeed, many of the design implications will be mutually exclusive and enacting all of them would overburden many if not all communication media. Rather, I consider the design implications to be grounded speculations to help connect the reader to the data and the themes and to inspire new forms of computer-mediated communication.

In the end, I hope the reader will come to appreciate what I found to be a surprising breadth of ways that users appropriate photographs in computer-mediated communication and to appreciate the often nuanced design decisions that support one use over another.

The Image as Amplification

Images are commonly appropriated for the purpose of amplifying some communicative intent. Emoticons are one example of this—simplified visual representations that imbue their surrounding communicative context with a particular affective state.

Another example of the image as amplification may be seen in the visual representations of comics:

...a form of amplification through simplification. When we abstract an image through cartooning, we're not so much

eliminating details as we are focusing on specific details. By stripping down an image to its essential “meaning,” an artist can amplify that meaning in a way that realistic art can’t (McCloud, 1993).

Within the comic visual language lies an alphabet based on human gesture, expression, and posture; an alphabet that amplifies through simplification and allows the artist to “convey nuances, support the dialogue, carry the thrust of the story, and deliver the message” (Barry, 1997).

One interesting class of the image as amplification in the Lascaux data was the participants’ use of shrugging (Figure 6.2). Used in much the same way that one might use an emoticon or the comic visual language to amplify emotional intent, the shrug emerged surprisingly from the Lascaux data, as I am aware of no existing IM client that offers an emoticon for shrugging.



Figure 6.2 Variations of a shrug.

The images focus solely on the details of the shrug and, through this focused simplification, arrive at an amplification of the communicative intent. The image conveys more about the shrug and its communicative context, however, than simplification in the manner that an emoticon simplifies and generalizes. There is evidence of immense nuance in these shrugs. No two

shrugs are the same—an empathetic shrug, a frustrated shrug, a helpless shrug, an annoyed shrug, etc...—and it is this emotional nuance that the photographic image amplifies.

In retrospect, the shrug seems to be a natural choice for amplification in Lascaux due to general camera placement and the cameras' typical field of view. Amplification of shrugs may have been seen by users as compelling because it combines a facial expression and gesture which, together, took up the entire field of view. Other forms of amplification may have been less prevalent because they required a different field of view. An amplified wink, for example, may have required closer camera placement or the ability to zoom in on just the eyes.

This observation has implications for supporting amplification in technologies of visual communication. Achieving diversity in what is amplified appears to be related to the amount and ease of mobility of the camera and/or the potential to change its field of view or zoom.

Other techniques for fostering amplification might involve providing additional capabilities of focus and simplification for amplification. One might provide the user with a software implementation of a fisheye lens, for example, to simplify the boundaries and focus attention towards the center of the image. Similarly, one might provide a visual mode that employs techniques of background extraction and automatically blurs the background to exaggerate the depth of field and make the subject of the image stand out.

The Image as Narrative

Use of images as narrative is strongly influenced by the control the author holds in crafting those images; that control is as much about what is included in the narrative as what is left out.

The Bayeux Tapestry is one example of the image as narrative, created within a generation of the 1066 Battle of Hastings to visually depict the story leading up to and including the Norman Conquest. There is an irony, however, embedded in its design. The Bayeux Tapestry was commissioned

by a Norman, a victor of the conquests, of an Anglo-Saxon artisan, one of the conquered. That the conquered retold the story of their own defeat affected the point of view of the narrative. That authorial control impacted how the story was retold as well as the iconography of the retelling (Bernstein, 1986).

Taking similar advantage of authorial control with dramatically different content, one Lascaux participant employed the image as narrative with a particularly humorous bent. This user composed his images to selectively include only one of his two juice bottles at any given time, a sleight of hand that lured his coparticipant into thinking he had consumed an impressive amount of liquid in a very short period of time. He presented the punch line to his narrative by revealing that his joke used two props instead of one.

Jimpy:



Mara: now that is the way to do it

Mara: i have to get up and go to the kitchen to get my refills

Jimpy:



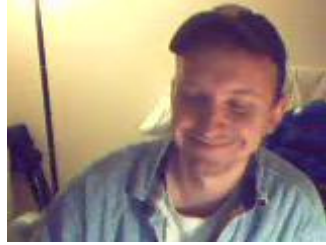
Jimpy:



Mara: all i have to say to that is

Mara: when you bolt for the bathroom in the next two minutes, don't take your camera with you

Jimpy:



Jimpy:



Mara: special effects

Jimpy:



What, then, were the specific characteristics of this medium that fostered a narrative form of visual communication? And more generally, what would a technology need to do to support narrative visual expression? In this example, the control afforded by the medium in the composition and timing of shared images enabled the user to carefully craft this narrative for his particular intent⁵. In lieu of post-production editing, it seems that technologies that support intentional omission and “behind the scenes” control are useful in fostering narrative.

Most of the narrative I observed in the Lascaux data was of the serial comic type, primarily a sequence of authored images. While Lascaux allows for the flexible interleaving of text and image, it does not support the coupled relationships between text and image that are often found in narrative, for example, image captioning or the use of text within a photo. One might further explore the image as narrative by providing various options for the

⁵ See Koskinen, Kurvinen & Lehtonen (2002), p. 52, for another example of the image as narrative supported by control in crafting images.

coupling of text and image (e.g., Comic Chat (Kurlander, Skelly & Salesin, 1996) or fotoTXT⁶).

In addition, most of the narrative I observed in the Lascaux data was conveyed through character and props; very little context or setting contributed to the narrative. One might consider features that would allow for better utilization of setting—a real-time green screen, for example, and the ability to use any image as the backdrop to a narrative.

In examples of the image as narrative like the Bayeux Tapestry, the boundaries of narrative are strongly delineated. In Lascaux, there are no technological provisions to indicate when a narrative begins and when it ends. What is the role of boundary in narrative? Does it serve a social function, perhaps with the audience? If so, one might consider ways of demarcating the boundaries of narrative. In Lascaux, however, much narrative appeared to begin spontaneously, catalyzed by an interesting or unexpected image. The relationship between images and the boundaries of narrative is an open question and an interesting one, I believe, to explore within the design space of image-mediated communication.

If boundaries serve a more important role after the fact, it may be because many narratives are enjoyed repeatedly. One might better support the image as narrative by better enabling narratives to be re-enjoyed or re-experienced, for example by allowing users to create personal “diaries” of their narratives. One might also better support the image as narrative by supporting the retelling of Lascaux narratives. The potential for enabling informal publishing through reuse may be an interesting match for a medium based on peer-to-peer communication, as it incurs fewer of the costs associated with more public and/or persistent publishing, such as a webpage or a blog.

In the Lascaux data, I observed the joint authorship of visual pastiches—a visual pastiche of favorite desk toys or a visual pastiche of body parts that made the conversants feel old or tired. Not narrative in the traditional sense,

⁶ <http://www.fototxt.com>, accessed 5 May 2008

these collaborative pastiches do suggest that Lascaux is a medium in which collaborative authorship is being explored and perhaps even fostered by the use of images. The role of the image in fostering collaborative authorship would be an interesting question to explore through design. In addition, one might explore means of supporting the joint creation of other forms of narrative, perhaps by relaxing the traditionally tight coupling of user name and text or image, for example, by allowing the narrative to flow uninterrupted and unencumbered by intermittent changes in authorship.

The Image as Awareness

One of the more common research foci in the computer-mediated visual communication literature is the use of images to provide awareness. In the late 1980's and early 1990's, widespread computer networking and the availability of multimedia capture and playback devices engendered the development of media spaces (e.g., Bly, Harrison & Irwin, 1993; Dourish & Bly, 1992). In a common instantiation of media spaces, users had an always-on array of thumbnail-sized webcam images providing nearly live video feed of coworkers' offices or shared lounges and workspaces:

Although seemingly the most invisible, the use of the media space for peripheral awareness was perhaps its most powerful use. The view, at first glance, appeared to be nothing more than a view of an empty public space. On closer examination, however, there was rarely more than a minute or two in which there were not at least sounds from the other location giving clues about the ongoing activities there.... Being aware of such activities required no response; it provided an overview of who was around and what was happening (and afforded the possibility of joining in) (Bly et al., 1993).

The image as awareness provides an overview of activity that need not be high-bandwidth or photorealistic. Babble, a threaded and persistent computer-mediated communication system, includes a social proxy as visual communication to depict users' presence and activity. In Babble, the conversation is depicted as a circle and the conversants as dots, within the

circle to varying degrees of activity or outside of the circle when participating in other conversations (Erickson, Smith, Kellogg, Laff, Richards & Bradner, 1999):

The idea was that users could be aware of the activities of other participants with respect to the conversation, so that a gathering crowd might entice others to join. Similarly, since this awareness would be shared by all participants and thus enhance accountability, phenomena such as a dispersing crowd might provide a way of shaping a conversation's content, style, or etiquette (Erickson et al., 1999).

In one example of awareness appropriation from the Lascaux data, a mutual friend of the coparticipants is taking leave after arriving and having become the subject of the conversation:

Jimpy: hey, does he want to exchange IM ID's?
Mara: He isn't using any external IM clients this summer
Mara: oh, i see
Jimpy: very well then
Mara:



Jimpy: i'll have to continue using an owl to send him messages

Given that much recent research in synchronous, remote visual communication has addressed issues of awareness or shared context, I had expected to see a more predominant use of the image as awareness.

One difference between Lascaux and media that seem to better foster awareness is the distinction between Lascaux's explicit, click-to-send mechanism and an always-on, polling mechanism. One might wonder about the possibility of fostering awareness through a polling mechanism in Lascaux. One of the study participants, in fact, altered his Lascaux code for a

period of time to experiment with having an image automatically sent about twice a minute. Instead of allowing the images to provide a more passive awareness, this user felt compelled to perform for the camera, providing a visual counterpoint to the other content of the instant message. Without this, he explained, "the images started to lose meaning because they weren't posed."

One might also better foster awareness with visual communication through aggregation techniques. One might consider macros to visually aggregate certain classes of contextual or awareness information. For example, if a locally-stored photograph were triggered every time someone walked past the camera, the user might have at her fingertips a representation of the "busyness" of the area that she could choose to send to a conversant at any time during an instant message.

It may also be that in future work, researchers will come to understand the extent to which critical aspects of awareness are conveyed implicitly through photographs with other primary intents, rather than explicitly through awareness-intended images.

The Image as Local Expression

Some images are appropriated as a way to create and maintain identity within a subculture. These images are often stylized expressions of local conventions or experiences. Often, this localized form of expression is inaccessible to those outside a subculture. Graffiti is one such example of this appropriation of the visual image.

Sometimes images evolve from being direct and accessible reflections of experiences to stylized and inaccessible forms of local expression. This evolution can be seen in the use of images dating back to the earliest known examples of visual communication. The African and European cave paintings of 35,000 to 4,000 B.C. were direct and accessible reflections of experiences, likely used in hunting rituals or as an instructional tool for the young on the cooperative hunting process (Meggs, 1998). Subsequently, however,

language was extended to express the communicative needs that arose within local subcultures:

As pictures became highly stylized and conventionalized according to local usage, they became more and more removed from experience and therefore less accessible to both people within the culture and to other cultures as well (Barry, 1997).

Four months of Lascaux use may still not be long enough to witness the development of stylized images; eight Lascaux users may not be a large enough population to discern which images are accessible to some subpopulations and not others. I did, however, observe examples of users experimenting with the medium, experimenting with images that could well evolve into local conventions. In one particular example, a user was trying to convey admiration to her coparticipant. She sent three images in quick succession in which her hands waved about her head. Her coparticipant sent an image of himself looking confused. The experimenter then translated the intention of her images: "tipping my hat to you." This particular series of images was not seen again in the data, but seems the type of experimentation with visual language that bears a certain degree of esotericness but that within local usage could come to be well-understood and commonly-utilized.

The image as local expression may be viewed as a grassroots phenomenon in which members of a subculture socially negotiate the emergent layers of meaning of their images. That said, the more flexible the input medium, the greater the expressive potential. In text messaging, for example, text input that was constrained by dictionaries (e.g., T9), would have impeded the appropriation of text messaging shorthand within subcultures. The lack of constraints on the photographic input in Lascaux, then, is more likely to enable the flexible, grassroots appropriation of the image as local expression.

It may be that it would have taken longer for the image to emerge as local expression because instant messaging is typically a dyadic medium and there are fewer opportunities for conventions to propagate (Volda et al., 2002). There are two additional issues at stake here, designing for the image as

local expression—the ability for local expression to be learned within a subculture and the ability for local expression to be reused within a subculture.

To support the learning of local expression within a subculture, one might allow images or series of images to be tagged with their intended meaning. One might create shared “scrapbooks” of favorite images. One might better support the forwarding of instant messages, instant messaging excerpts, or individual images through other communication media, such as email.

To support the reuse of local expression within a subculture, one might allow images or series of images, either from a shared or individual repository, to be pulled into the current instant message. For example, a social group might share an image of a favorite pair of shoes that they all understand to mean “I’m running late.”

The Image as Invitation

Anthropological studies have foregrounded the social role of the image—the image as an artifact that invites others to sociality. Kodak’s innovation of the “You press the button, we do the rest” camera in 1888 (Lubar, 1993) enabled amateurs to access the medium and appropriate the resultant domestic photography into an activity of social meaning-making. As anthropologist Richard Chalfen articulates, “[domestic photographs] are meant to be shared, and they are meant to prompt interaction” (Chalfen, 1998). The social invitation of the domestic photograph is to join in an “intertext of discourses that shift between past and present, spectator and image, and between all of these and cultural contexts, historical moments” (Kuhn, 1991).

That photos are viewed socially is echoed by researchers in the Computer Supported Cooperative Work community, both by those conducting their own field studies (Crabtree, Rodden & Mariani, 2004; Frohlich, Kuchinsky, Pering, Don & Ariss, 2002) and by those designing and developing technologies to support photo sharing (Balabanovic, Chu & Wolff, 2000; Shen, Frost, Forlines & Vernier, 2002).

Studies of the use of digital cameras in conjunction with mobile email devices (to email the photos) liken this new photographic activity to that of sending multimedia postcards (Koskinen et al., 2002; Lehtonen, Koskinen & Kurvinen, 2002). The existence of the postcard, it is argued, "depends upon [it] being sent to another person." Likewise, the significance of the multimedia postcard is "in the way it can form a basis for sociability.... The connection to other people and the capability to entertain them are ends in themselves; the 'utility' of the message is of secondary importance" (Lehtonen et al., 2002). The social invitation of the multimedia postcard carries an implied response:

To receive a message forms a binding relationship in a sense that some kind of reply is expected. This way it actually calls for a reaction, at least an expression of gratitude, if not an outright return of gift (Lehtonen et al., 2002).

It is likely the case that images used within a communicative medium are inherently social, but some communication functions as an invitation to enriched sociality. In the following example, the images provide an invitation for the user's coparticipant to share in her experiences, to share virtually in the amusing exploits of her cat and to push the boundaries of virtuality by sharing what she is eating as well.

mokona: pan is hiding under the bed
mokona: it's her new favorite hide and seek place
mokona: she's pouncing on my head
Umi-chan: hehe
mokona: i'm lying on the floor eating strawberries
listening to the game

mokona:



mokona: oops.. she went under the bed again

mokona:



mokona: she's trying to find spiders again
[...]

Umi-chan: puu?

mokona: strawberries so good

Umi-chan: me want strawberries

mokona:



Given an expectation that images are used as invitation, however, what were missing from the Lascaux data were images used at the very outset of an instant message. I saw instances of one line greetings (e.g., "Hi!" or "Hey Scott") followed by a photograph (often a wave) but none in which a photograph was used to begin an exchange. One limitation of our protocol was that an instant messaging session had to be established in text before images could be sent. A medium that would better foster the image as invitation would allow images to initiate an exchange.

In the context of instant messaging, it is often common to provide an indication of status (e.g., "Busy" or "Out to Lunch"). Previous research has documented user customization of this status field to provide detailed and sometimes humorous status information (Grinter & Palen, 2002). Such customized status, in many cases, may also be viewed as an invitation (e.g., read as: "Distract me! I'm tired of writing"). A medium that better supported the image as invitation might allow users to set visual status as an invitation (or dis-invitation) to enriched sociality.

Previous research on teen use of cellphones has noted that meaningful social exchange may take on the additional form of gift-giving (Taylor & Harper, 2002). In the context of cellphones, teens saved text messages that held particular significance for them. In the context of visual communication, one might better support enriched sociality by providing a way for particularly significant photos, instant messages, or excerpts to be saved in a way that would help validate and foreground their significance as gifts.

The Image as Object/Instrument

The final theme of the appropriation of visual images reflects more of a continuum between viewing the image as an object and the image as an instrument. This distinction has also been explained as the difference between communication in which the focus is *on* the image (image as object) versus communication in which the focus is *through* the image (image as instrument).

A more concrete example of this distinction may be seen in the history of the use of images in the Catholic church. In Europe, prior to the seventh century, the use and, in some cases, worship of the religious image was firmly in place:

Under the successors of Constantine, in the peace and luxury of the triumphant church, the more prudent bishops condescended to indulge a visible superstition for the benefit of the multitude.... By a slow though inevitable progression the honours of the original were transferred to the copy: the devout Christian prayed before the image of a saint; and the Pagan rites of genuflexion, luminaries, and incense again stole into the Catholic church (Gibbon, 1960).

During the reign of Leo the Iconoclast, however, the use of images was abolished as being a return to paganism and idolatry. It was not until the ninth century that the legitimacy and veneration of images was re-established (Kallistos, 1986). The emergent theological justification for the use of religious images emphasized the distinction between the image as an

object *on* which one is focused and the image as an instrument *through* which one is focused. The image as instrument transcends that which is the image as object.

This same distinction has also been made in reference to the images of the nineteenth-century art world. Marshall McLuhan speculated that the greatest revolution caused by the photograph was in the visual arts. Because a painter could no longer compete with the realism of the photograph, he turned to impressionism:

...in the pointillisme of Seurat, the world suddenly appeared *through* the painting. The direction of a syntactical point of view from outside *onto* the painting ended as literary form dwindled into the headlines with the telegraph (author's original emphasis) (McLuhan, 1994).

In the Lascaux data, there appeared to be a continuum between images that functioned more as objects and images that functioned more as instruments. In the following transcript, for example, while the communicative intent is to share the discovery of a book, the image of a book is primarily just that, a book—an object.

Scott: I was at the library
Scott: The librarians are so nice here
Scott: I got myself a book to per-oose
Mara: cool
Scott:



Mara: hahah
Mara: excellent

In the previous example of the image as narrative, the image of a juice bottle is situated somewhere between an object and an instrument. The juice bottle functions somewhat as an object, as it is being used a prop in the

communication. But the juice bottle is also being used as an instrument through which the communicant is being clever; here, the image is also a joke. And in the previous example of the image as invitation, the image of a strawberry is very little about the strawberry. The significance of the image is not its object-ness. The significance of the image is as an instrument through which an invitation to sociality is proffered.

Finally, one might anticipate a class of image as instrument that requires such artistic mastery of the medium that it has not yet been observed after only four months of use.

It seems that the flexible interplay of text and image in Lascaux is sufficient for supporting the image at many points on the continuum between object and instrument. If one hypothesizes that there is a class of image as instrument that will eventually parallel the artistic paradigm shift of pointillisme, what may foster that use of the image may not be any one particular feature or affordance of the technology, itself. The emergence of the image as artistic instrument may result from a unique configuration of the technical flexibility of this medium, other communicative or artistic technologies, and the social context in which they all play out.

If the image as artistic instrument emerges as a new way of seeing in a medium, it also implies that an existing or conventional way of seeing in a medium has been established, a matter of long-term adoption and appropriation.

LITERACY, MASTERY & APPROPRIATION

There is a strong relationship between literacy, mastery, and the appropriation of classes of communication. The initial design of Lascaux anticipated less nuanced understandings of literacy and media access. I chose to study visual communication in the context of instant messaging because of its accessibility compared to other communicative media. This design decision reflected an understanding of the role of gatekeepers, a role that can be seen throughout history.

The first examples of the illustrated manuscript (as early as 16th Century B.C.) were funerary papyri, more commonly referred to as *The Book of the Dead*. They were commissioned of Scribes to foretell the deceased's journey into the afterlife (Meggs, 1998). *The Book of the Dead* were written in a hieroglyphic sacred language that only the Scribes used and understood (Barry, 1997). Most Egyptians, then, were not able to leverage this form of visual communication for their own expressiveness; only the Scribal gatekeepers, in this case, could be considered literate.

That visual communication was controlled by cultural gatekeepers was not uniquely endemic of the ancient Egyptians. Contemporary visual gatekeepers congregate around certain areas of California and New York:

Most film and television, consequently, has been controlled by a caste: the high priests of Hollywood and Sixth Avenue—a caste almost as closed and as narrow as that of the scribes of ancient Egypt... Except for some primitive home movies, in moving images most of the rest of us have been, to use a formulation of Alan Kay's, only half "literate."... We have been living with the frustration of a one-way form of communication, the frustrations of the mute (Stephens, 1998).

In general, Lascaux serves to promote visual communication literacy, placing an authoring and expressive potential in the hands of non-gatekeepers. Lascaux is not a one-way, controlled and disseminated medium; the user has personal control of the medium and modality as well as control of what and when to convey, enabling expressiveness, creativity and even a little sleight of hand.

Within Lascaux, however, I came to understand that the literacy Alan Kay talks about is as much about individual technical affordances as it is about cultural gatekeepers. Literacy is about access to the expressive potential of a medium. To the extent that any technical capabilities of a system are out of reach, any classes of communication that rely on that specific technical capability are also out of reach. It is even then that one's literacy is compromised.

In the current version of Lascaux, a mouse click is required to send an image. In general, this meant that when a user was in the photo, only one hand could ever be seen; the second hand was on the mouse. Certain users, however, found work-arounds to this "limitation," creating subpopulations of users who were and were not able to access the expressive potential of two-handed images. Imagine, for example, not being able to tell a "fish tale" because you do not have two hands available to show how big the fish really was. In the Lascaux data, users often used two hands extended as far as the boundaries of the camera to convey just how wonderful someone was, as the answer to the typically rhetorical question "How awesome are you?" Those whose two-handed literacy was not compromised flaunted their ability to generate a "two-handed photo," often to the great frustration of their coparticipant.

Anna:



[...]

Paul: I can't do it!

[...]

Anna: try to concentrate on it

Anna: really really hard

Paul:



[...]

Anna:



Paul:



Anna:



Anna: not working yet?
[...]

Paul:



Anna: see!!!!

The broader implication of the two-handed photo observation is that the appropriation of visual communication for a particular communicative intent is directly related to literacy. Whether one's intent is to compliment someone, to tell fish tales, or to use the image as amplification, narrative, awareness, local expression, invitation, or object/instrument, the accessibility of a technology or even certain features of that technology for mastery will be a significant factor in determining whether the image is appropriated within a medium.

This research highlights the potential impact of relatively subtle design decisions on the appropriation of visual communication. Even a decision such

as having users click a button to send a photo can have dramatic impact on the ability of users to access entire classes of visual communication.

CONCLUSION

Although this research does not completely “close the loop” between observations of human activity and the implementation of new forms of computer-mediated communication, I believe that my efforts at identifying design implications based on my analyses of image use across multiple contexts validates the usefulness of these themes of appropriation as a lens for examining a breadth of communicative roles of the image in instant messaging.

This research constitutes an initial snapshot of visual communication in instant messaging. This exploration began with the design and use of an instant messaging client, Lascaux, which enables users to send both webcam photos and text in instant messages. My analysis of the Lascaux data and of other accounts of the use of images in communication have led me to outline six themes of the communicative appropriation of the visual image. Considering the themes as provocative predictors of future visual communication practices, I then built upon this analysis to suggest potential design techniques for supporting each thematic appropriation of the visual image.

Taken together, these three perspectives amplify each other—the Lascaux data analysis, the analysis of image use in other contexts, and the grounded speculation of design implications. In the end, I have offered six themes of the appropriation of the image and numerous potential research and design trajectories for the integration of visual communication with computer-mediated communication technologies.

CHAPTER 7

WILL THE REAL CAMERAPHONE PLEASE STAND UP? MULTIPLE IDENTITIES AND INTERPRETATIONS OF THE CAMERAPHONE

Once it became feasible to find people who used multimedia messaging within the United States, I turned to study its use, as well. I wanted to study not only individuals who created multimedia messages, which was the focus of most cameraphone research at the time, I also wanted to study individuals who received multimedia messages. So I turned to study the multimedia messaging and cameraphone use of a small, social cohort. Data from this study suggested that, even within a small, social cohort, there were a diversity of interpretations of the cameraphone and that these interpretations were dynamic and influenced other communication practices within the social network.

INTRODUCTION

With the increasing ubiquity of digital cameras—now frequently embedded in computing platforms with network capabilities—research exploring how digital photographs are used in computer-mediated communication has surged. Most striking, perhaps, are the breadth of ways that users have appropriated photographs in computer-mediated communication technologies. Researchers have documented the use of these technologies for collaborative storytelling (Koskinen, Kurvinen & Lehtonen, 2002) and for elevating the mundane “to a photographic object” (Okabe & Ito, 2003). Mäkelä, Giller, Tscheligi, and Sefelin noted that photos were used for joking, expressing emotion, and sharing art (2000). Ling and Julsrud identified grounded genres of use including documentation of work-related objects, visualization of details and project status, snap shots, postcards and

greetings, and chain messages (2005). Kindberg, Spasojevic, Fleck and Sellen proposed a taxonomy of image capture, with images serving either social or individual uses and either affective or functional uses (2005). Van House, Davis, Ames, Finn and Viswanathan identified uses including creating and maintaining social relationships, personal and group memory, self-expression, self-presentation, and functional (2005). Volda and Mynatt proposed themes of the communicative appropriation of images including amplification, narrative, awareness, local expression, invitation, and object/instrument (2005b).

My goal is, in part, to build upon this body of research about how people use digital photographs in computer-mediated communication by exploring some of the influences on the way individuals use one pair of these technologies—cameraphones and multimedia messaging. Particularly given the breadth of uses reported, what influences some individuals to use these technologies in one way while others use them in different ways? What influences some individuals to adopt these technologies while others do not?

To address these questions, I undertook an empirical study of one existing social cohort's established practices of computer-mediated communication with cameraphones. In this research, then, I make the following contributions:

- *I distill three interpretations of the cameraphone held by participants in our study.* I draw from the language our participants used when talking about their cameraphones, the ways in which they used or did not use their cameraphones, and their experiences with related technologies to connect these three interpretations with communication practices similar to those identified in prior studies of cameraphone use. The implicit claim that users can have different interpretations of technology is a claim that has been made by other researchers in HCI and related fields (e.g., Oudshoorn & Pinch, 2003; Sengers & Gaver, 2006).
- *I provide evidence for the influence of remediation in the construction of interpretations of technologies.* I foreground the influence of personal

experiences with other, related technologies in the interpretation and reinterpretation of cameraphones.

- *I characterize the dynamic interactions among interpretations within a social network.* I provide examples of the ways that communication is affected when conversants hold different interpretations of their cameraphones. Additionally, I point to examples of the gradual evolution of interpretations through successful and failed experimentation and exposure to other interpretations.
- *I suggest design implications based on my empirical study of cameraphone use.* These design implications highlight directions for potential product differentiation as well as design scaffolding for migrating individuals from one interpretation to another.

METHOD

I conducted an eight-week case study of the use of cameraphones by a multi-generation, multi-household extended family that had existing cameraphone practices and both social- and work-related communication practices.

Participants

My selection of participants fulfilled multiple criteria, each specifically related to a goal of this research:

- The participants should all be part of a tightly connected social group. This criterion would enable the data to speak to the consumption and production, intent and interpretation, of many of the same photographs.
- The participants should be part of a group with both social- and work-related communication needs. This criterion would enable the data to speak across a continuum of social and work-related communication practices.
- The participants should all have owned their own cameraphones for a substantive period of time prior to the start of the study. This criterion would help to ensure that participants had established practices of use or

non-use (with established practices of non-use being as important as practices of use in understanding patterns of adoption).

The participant group was an extended family in which all but the teenage daughter had responsibilities in a family-owned and -operated industrial automation business. In addition, this extended family of 6 had both collocated (they all lived in the same city in the United States, many worked together, and all ate lunch together at least once a week) and distributed (the family business required frequent travel) communication practices. The participants in this study represented two generations of one extended family in the United States—two parents, two adult sons, the wife of the elder son, and a teenage daughter (Figure 7.1).

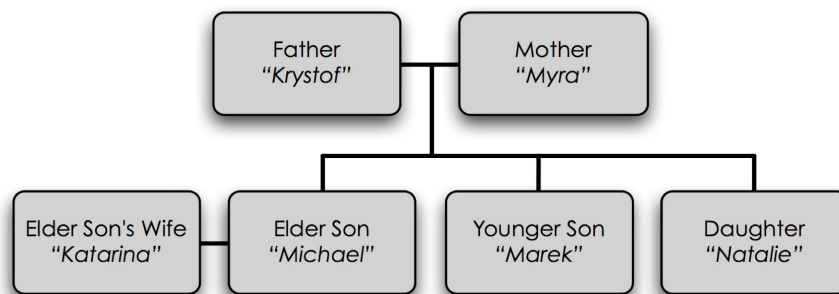


Figure 7.1 Family tree of study participants (all names are pseudonyms).

All participants had owned their own cameraphones (with VGA resolution cameras) for at least a year and had service plans that included coverage of some multimedia messaging service (MMS) use. All participants except Myra had used the cameras on their phones prior to the start of the study. All but Myra and Natalie had used the MMS capabilities of their phones prior to the study. I recruited these participants via word-of-mouth referrals and traveled out of state to conduct the study.

Data Collection

The primary source of data for this study was a series of semi-structured interviews. I conducted a group interview prior to the start of the study and

individual interviews after weeks four and eight. The group interview lasted approximately two hours and each individual interview lasted approximately one hour, for a total of approximately 14 hours of interview data.

The individual interviews were focused around two additional forms of data collected throughout the remainder of the study. First, I asked the participants to email me copies of photos that they took on their cameraphones, shared from their cameraphones, or were shown on a cameraphone (either received on their cellphone, in email, or viewed in person on a cameraphone display). Second, I collected data about each of these different types of cameraphone experiences via voicemail experience sampling—an event-driven version of Palen and Salzman’s voicemail diary studies (2002). The voicemail experience sampling allowed me to gather data about each cameraphone experience as close as possible to the moment of the actual experience, giving me a more timely account of the meaning and intention or interpretation of the interaction. The voicemail component of the study was carried out via an automated voicemail system capable of providing recorded prompts and recording multiple-answer and open-ended responses. The voicemail study consisted of a series of open-ended questions about the participants’ most recent cameraphone experience, as well as a few multiple choice questions used to classify the type of experience (e.g., did you take a photo, share a photo, or view a photo that had been shared?) and to route the participant to the appropriate set of open-ended questions on the phone tree.

During the group interview, I asked participants about their relationships with numerous different communication and photographic technologies and asked participants to generate egocentric network diagrams of their social networks with respect to these different technologies.

I compensated participants for any costs associated with sending photos via MMS, for participating in interviews, and offered small monetary incentives for sharing their photos with researchers and calling in to the voicemail system.

Data Analysis

My initial data analysis occurred in parallel with the data collection; this analysis was inductive. I coded the data for emergent themes, the most prominent of which was the relationship between participants' cameraphone use and their use of other, related technologies. I tailored portions of the final interviews to explore these emergent themes.

After this initial analysis, I became aware of the resonance between the emergent themes in the data and the theory of remediation from media studies (Bolter & Grusin, 1999). In my second round of analysis, then, I adopted this theory (which I will discuss later in greater detail) as an analytic lens. I coded transcripts from both the interviews and the voicemail experience sampling based on both direct and indirect references to other, related technologies.

I analyzed photographs using open coding techniques, generating categories of appropriation similar to related work in the field for purposes of comparison. Finally, I aggregated participants' egocentric network diagrams for each communication and photographic medium.

SUMMARY OF DATA

Before discussing the analytic lens and presenting my analysis, I provide a brief summary of my data, characterizing the frequency and nature of cameraphone use, including the types of photos taken and how they were shared, the relationship between the use of the cameraphone and the use of other communication media, and the various meanings participants attributed to the cameraphone.

Overview of Cameraphone Use

During the study, the 6 participants took a total of 36 photos with their cameraphones. The use of cellphone cameras varied widely within and among participants. Krystof, for example, took one photo the day after the initial group interview and did not use the camera on his phone again for the duration of the study. On the other hand, Michael took nearly a third of the photos in this study, approximately half of which were shared with either his

younger brother or wife. While Michael took half of his photos over the course of just one week, there were also five weeks in which he took no photos at all. Natalie, in contrast, took an average number of photos with her cameraphone, but although other family members occasionally watched her take some of the photos, she only ever intended to share one of them.

The frequency of cameraphone photographs taken by the study participants is slightly less than the North American average and I will discuss possible reasons for this later¹. On the whole, however, the usage patterns reported in this paper do not differ as significantly from industry statistics about North American cameraphone use as they do from statistics reported in previous research about the cameraphone use of North American early adopters (e.g., Kindberg et al, 2005; Van House et al, 2005).

The types of photographs that the participants took with their cameraphones were consistent with previous research in the area. Of the photos taken over the course of this study, nearly two-thirds were of classic “Kodak Culture” subjects—subjects traditionally taken with film cameras, such as family members, pets, and vacation sites (Chalfen, 1987; see also Okabe & Ito, 2003). The data also included photographs of personal achievements (see also Kindberg et al., 2005), photographs of business documents and project status (see also Ling & Julsrud, 2005), and photographs that were turns in multi-party, multi-turn communication (see also Koskinen et al., 2002).

In the voicemail experience sampling and follow up interviews, I asked participants what they had done with their photos, whether they had saved them for themselves or shared them in one or more ways.

Just over one-third of the photos were sent by MMS to others, although several of these were never received. Participants emailed one quarter of the

¹ In a 2005 survey of North American cameraphone owners, only 53% of respondents actually reported taking photos with their cameraphone (Sprint, 2006). An InfoTrends report also released in 2005 found that the North American cameraphone owners who do use the cameras on their phones were taking approximately 20 photos per month (InfoTrends, 2005a). An informed but non-scientific extrapolation of this data would suggest that the average number of photos taken by North American cameraphone owners (including those who do not use the camera on their phone) is approximately 10 per month or 2 photos per person per week.

photos to themselves and then shared the majority of those later in face-to-face contexts. Relatively few photos were emailed to others, and those that were were primarily emailed to people who did not have cameraphones. One quarter of the photos were not shared during the eight weeks of our study. In some cases, participants took the photo without any intention of sharing it; in other cases, participants took the photo intending to share it later but never did².

The Cameraphone in its Broader Communicative Context

Through a series of egocentric social network diagrams, participants self-reported social networks for eight different communication modalities: face-to-face, in-person interaction; audio phone calls on mobile phones; audio phone calls on landline phones; text messaging on mobile phones; multimedia messaging or other cameraphone photo sharing; email; instant messaging; and sharing of digital photographs taken on digital cameras other than their cameraphones (e.g., through sharing prints or as email attachments).

If one thinks of the cameraphone as two constituent technologies—the mobile phone and the digital camera—it is interesting that participants reported larger social networks for each of the constituent technologies (4 individuals and 0.7 groups reported, on average, in social networks for mobile phones and 3 individuals and 1 group, on average, for digital cameras) and a smaller social network for the technology that blends the two—multimedia messaging (2 individuals and 0.5 groups, on average). This observation raises important questions about the perceived role of the cameraphone relative to other communication modalities. We later discuss some reasons for participants sharing cameraphone photos with smaller social networks (e.g., the discussion of Michael’s sharing of photos taken on

² In general, participants found it easier to remember to call in to our voicemail system when they had taken a photo than when they had viewed someone else’s photo. In interviews, participants had an easier time remembering what photos they had taken than what photos they had viewed. As a result, I do not believe that I have a complete account of who had viewed each of the photos in the study, particularly for the cases in which photographers or original recipients of a photo shared it with others at a time that was significantly removed from the experience of originally taking or receiving the photo.

a business trip or the occasions when messages were sent but never received), but these questions deserve a more focused exploration in future work.

The Meaning of the Cameraphone

In the voicemail experience sampling, I asked participants to tell me what having a cameraphone meant to each of their cameraphone experiences—a prompt that has been previously used to understand the meaning of instant messaging (Volda, Erickson, Kellogg & Mynatt, 2004). I asked what having a cameraphone allowed them to be. Their responses included the following: quick, spontaneous, funny, humorous, silly, cute, homey, independent, free, clever, artsy, creative, annoying, not annoying, well-connected, communicative, social, informative, productive, and more effective.

These different responses foreshadow the variety of different meanings that the participants had constructed of their cameraphones. In the next section, I describe three such interpretations as well as the analytic lens I utilized to bring these interpretations into relief within the data.

INTERPRETATIONS OF THE CAMERAPHONE

The new media theory of remediation argues that the identity of a technology is bound up in the identities of related technologies, both past and present:

...media can best be understood through the ways in which they honor, rival, and revise [other media]. No medium today, and certainly no single media event, seems to do its cultural work in isolation from other media, any more than it works in isolation from other social and economic forces (Bolter & Grusin, 1999).

Film photography, for example, has been said to have remediated painting. It was said to explore advances in realism and linear perspective in a way that painting was not able to achieve. But Bolter and Grusin argue that remediation also works reciprocally. The ability of early photography to capture light and color was not particularly refined. Painting, then, remediated photography by exploring aesthetics of light and color. That

remediation was the birth of the Impressionist movement (Bolter & Grusin, 1999; McLuhan, 1994).

To understand the larger ecology of media in which remediation by and of cameraphones takes place, one can hold up research that documents the use of cameraphones for personal and group memory (e.g., Van House et al., 2005) and note that this use was previously attributed to film photography (Chalfen, 1987). Or, one can hold up research that documents the use of cameraphones for maintaining social relationships (e.g., Van House et al., 2005) and note that this use was previously attributed to initial forms of computer-mediated messaging (Nardi, Whittaker & Bradner, 2000).

Drawing from the theory of remediation, then, I argue that an individual's experience of a technology is bound up in his or her experiences of related technologies, both past and present. Using the theory of remediation as an analytic lens, I identified three different interpretations of the cameraphone held by the participants. I arrived at these interpretations through inductive data analysis and, in particular, by triangulating three types of data: (1) the language that individuals used when talking about their cameraphones; (2) how the participants used or did not use their cameraphones, including the classes of subject matter photographed and whether or not the participants shared their photographs; and (3) individuals' experiences with and exposure to related technologies, particularly their digital cameras and cellphones.

The three interpretations that I uncovered in this data included a visual communication medium, an omnipresent digital camera, and a digital camera of last resort.

The Cameraphone as a Visual Communication Medium

[Katarina] said her cameraphone was most like the Internet because it allowed you to share things, communicate, and send messages. She said that with both the Internet and the cameraphone, you don't feel alone.... You feel connected to the world.

- Excerpt from Fieldnotes, 4 May 2005

Katarina consistently framed the cameraphone as a medium for visual communication. She sent photographs of her cat via email to her parents in Eastern Europe. She sent the majority of her photographs to her husband at work: "I just want to share something from home. Make his day or something like that." Katarina had existing practices of sending text messages to her husband at work; her use of MMS reflected similar communicative goals. With the addition of a camera to her cellphone, she believed that "it is better to show pictures."

While other family members interpreted photographs as having social and communicative potential (e.g., Krystof uploading photos from his regular digital camera to a server so that he could select ones to share), Katarina was the only participant who expressly interpreted the cameraphone as being fundamentally social and communicative.

With the cameraphone interpreted as a visual communication medium, the photographs taken did not merely ground communication; they were communicative turns in their own right. Frequently, the subject matter of the photograph held its significance because of the specific context—both physically and temporally—of the sender and the receiver.

Occasionally over the course of the study, the cameraphone enabled multi-party, multi-turn, semi-synchronous communication and this seemed both to surprise and delight the participants. While on a business trip, Marek saw a member of the Saudi Arabian ruling family. He took a photo and sent it via MMS to his father and brother. They both very quickly replied with text messages of their own. When Marek met up with his friends and colleagues that evening, he was less excited to tell them about his brush with royalty than he was to tell them about the responses he had received to his MMS.

The interpretation of the cameraphone as a visual communication medium is the most frequently implied interpretation in other research in the area. It is important, however, to differentiate between references to the cameraphone as a visual communication medium because it possesses the features necessary for supporting visual communication from individuals' interpretations of the cameraphone as a visual communication medium. The

presence of a particular feature set does not necessarily mean people will use those features or will interpret the technology as such. Of the 6 participants in this study, in fact, only Katarina consistently interpreted her cameraphone as a visual communication medium. In my data, the remaining two interpretations were both more prominent.

The Cameraphone as an Omnipresent Digital Camera

It made me feel like...it's always there when I need it...like I have something to rely on whenever I need it.

- Natalie

Several family members expressed an interpretation of the cameraphone as an omnipresent digital camera. Participants who reflected this interpretation recognized that the cameras on their phones were different from their regular digital cameras, but they did not synthesize the capabilities of the combined communicative and photographic feature sets. They still viewed the cameras on their phones primarily as digital cameras, but with an awareness that one might use the camera for taking different kinds of photos because it was carried more frequently than a regular digital camera. Individuals who interpreted the cameraphone as an omnipresent digital camera demonstrated an expanded photographic repertoire including subject matter that was both more "freaky" and more mundane than subject matter taken on regular digital cameras. For Natalie, having a cameraphone as an omnipresent digital camera meant that she could engage with the mundane aspects of everyday life—photographing a pair of handprints as she walked her dog (Figure 7.2) or a bunch of miniature bananas at the grocery store.



Figure 7.2 Natalie on April 17—Saved for self on phone.

This appropriation of the omnipresent digital camera resonates with Okabe and Ito's observation that cameraphones can change what is considered "photo-worthy" (2003). For other family members, interpreting their cameraphone as an omnipresent digital camera meant being able to take pictures of "freak stuff": the cat killing a chipmunk (Figure 7.3) or a celebrity sighting.



Figure 7.3 Michael on May 14—MMS to Marek.

Family members who interpreted their camera as an omnipresent digital camera reported that it allowed them to be "quick" and "spontaneous."

The always-on-hand nature of their cellphones seemed to influence these participants' interpretations of the cameraphone as a digital camera, incorporating the same notions of on-hand-ness and omnipresence.

The Cameraphone as a Digital Camera of Last Resort

If there's something really nice around the house, I take the regular camera. If I go somewhere with the family, I take the regular camera.... It's really more if something special happens and I don't have the regular camera.

- Michael

Another view of the cameraphone within this family was of its identity as a digital camera of last resort. The cameraphone was only reluctantly used if the "regular" digital camera was unavailable. Michael only took the six photographs in week one using his cameraphone (e.g., Figure 7.4 & Figure 7.5) because he was away from home on a business trip and had forgotten his regular digital camera. Michael said he typically would have shared these photos with his entire family after returning from his trip. Because he had taken these photos on his cameraphone, however, he was uncertain about how well they had turned out. He emailed the photos to himself so that he could check their quality later on his personal computer. When he did so, he decided that the quality of the photos was too poor to warrant sharing them.



Figure 7.4 Michael on April 20—Emailed to self.



Figure 7.5 Michael on April 20—Emailed to self.

When Michael reflected on his cameraphone photos, he focused on their lack of quality; he thought his cameraphone did not work well in common lighting conditions (e.g., Figure 7.5) and considered the phone to be a very poor platform for reviewing the quality of the photos taken.

Krystof had a similar interpretation of the cameraphone; he compared it directly and unfavorably to his digital camera: "...we don't use the phone so much because the quality sucks, but we like to make pictures."

Krystof, Michael and Marek were the primary owners of digital cameras. They had both owned their digital cameras for several years and had established practices for using their digital cameras. As Krystof explained, for example, "I like to make pictures...it's a nice hobby.... I've got a server at home so I just keep it on the server all those pictures and then I pick up some that I like and email it."

These individuals seemed to construct interpretations of their cameraphones based most strongly on their experiences with their digital cameras. They either did not use the cameras on their cameraphones or they used their cameraphones to take primarily the same kinds of photographs that they would have taken with their regular digital cameras. As such, this interpretation of the cameraphone also seemed to reinforce their existing interpretations of their regular digital cameras as high-quality capture devices.

This interpretation of the cameraphone's identity is somewhat contrary to the portrait of innovative adoption and appropriation painted by much research in this area, but it may reflect a very valid form of cultural inertia. As Bourdieu notes, a strong majority of photographers have existing photographic practices with respect to what they consider photo-worthy: "More than two thirds of photographers are seasonal conformists who take photographs either at family festivities or social gatherings, or during the summer holidays" (Bourdieu, 1990).

While new technology may enable changes in practice, those changes in practice do not necessarily follow. Many of the participants, as Marek explained, just wanted to take the same kind of photos they had always taken and to have a camera that would make it as easy as possible to do so: "I'm perfectly happy with all the pictures I take, content-wise.... I'm still going to be taking all of the same pictures."

FROM INDIVIDUAL INTERPRETATION TO DYADIC (MIS)COMMUNICATION

The influence of individual interpretations of technology on communicative practices within social networks became most obvious when two communicants' interpretations of their cameraphones did not match. In the following two examples, the recipient of a multimedia message constructed an interpretation of the message that was different from the sender's intended meaning. In one case, this meant that the response appeared to be a non sequitur and, in another case, there was no response at all.

In the first instance of this type of mismatched communication, Michael was traveling on business when he noticed some landscaping that he liked: "I thought they had a neat arrangement of plants and stones." He and his wife had been talking recently about landscaping their home. Likely viewing the cameraphone as an omnipresent digital camera, he photographed the landscaping and sent it via MMS to his wife. He did not send it to her as context-sensitive communication from which he expected a response. He sent it as an artifact—a conversational placeholder—that he could use later to

ground a conversation: "I think me and my wife will talk about it when [my colleagues and I] get back just to see if she likes what I sent her."

Upon receiving her husband's photo, however, Katarina reported: "I received a photo of a garden.... My husband just found a garden and he want to share it to me.... He never really before sent a picture of garden to me. Maybe I will respond maybe I not, I don't know yet." Here, Katarina is trying to understand the meaning of the garden photo that her husband had sent. She notes that he has never sent a photo like this before and she is trying to decide whether or not she ought to respond. Katarina frequently viewed her cameraphone as a medium of visual communication and seems to apply that interpretation to this exchange. In this case, she decided that his photo required a response and sent him a photo of a small plant in one of their flowerbeds in return (Figure 7.6).



Figure 7.6 Katarina on May 18—MMS to Michael.

Her response may seem like a communicative non sequitur, given what is known about her husband's original intent, but her individual interpretation of the cameraphone as a visual communication medium makes this response seem much more coherent and reasonable.

In a second example, Marek was standing in for a coworker at a business meeting. During the course of this meeting, he landed his first sale. He took a photograph of the purchase order and sent it via MMS to his father,

Krystof. Marek was particularly excited and wanted to use his cameraphone to communicate his personal sense of accomplishment: "I just took a photo of a P.O. I got from a customer and it's meant to communicate that I got my first sale!"

Krystof, on the other hand, did not seem to interpret his son's message in that way. Instead, he likened the message he received from his son, a photograph of a purchase order, to updates that are made to the database of jobs in the office computer system: "Normally it goes through a system...doesn't change anything, just to let me know he got it." With respect to taking and sharing photos, Krystof did not view the cameraphone as a visual communication medium. It seems likely, then, that he did not interpret photos that he received as being particularly communicative, either. He made sense of the photo he received by relating it to the most similar artifact he knew, in this case the updates to the jobs database in the office computer system.

Underlying each of these dyadic negotiations for communicative meaning are the individuals' interpretations of this technology.

In their discussion of instant messaging, Volda, Newstetter and Mynatt note that establishing shared conventions in dyadic computer-mediated communication is more difficult than in other communication media where there are a greater number of communicants and the conventions of use are more visible (2002). With cameraphones, the conventions of use are not yet established and the interpretations of what this technology is and what it might be used for are variable. Because of the dyadic nature of cameraphone interactions, it might be similarly difficult for interpretations to be shared and conventions made visible.

REINTERPRETING THE CAMERAPHONE

Bolter and Grusin argue that remediation is a dynamic process—media are constantly changing in response to the remediation of other media (1999). Likewise, I believe that individuals are constantly reinterpreting the

cameraphone and constructing new meanings based on the dynamic accumulation of experiences with it and other related technologies.

Over the course of the study, I noted several experiences that foregrounded the dynamic nature of the participants' interpretations of their cameraphones. Some experiences fostered new interpretations of the cameraphone while others highlighted the importance of functioning system features in fostering new interpretations:

- In an interview, Marek told me about his last visit to a botanical garden. He had brought both his regular digital camera and his cameraphone with him. During this visit, he took numerous photographs of plants and flowers using his regular digital camera. At one point, he decided that he wanted to share some of the photos with others; he also realized that his cameraphone would do both—allow him to take the photos and share them. He then proceeded to take duplicate copies of some of the photographs he had already taken on his regular digital camera using his cameraphone so that he could share them immediately with friends. The communicative need that arose out of this context of use spurred what seems to be a new interpretation of his cameraphone.
- One evening after work, Marek tried to send a photograph of a pint of beer to a colleague to let him know that a group of co-workers had convened at a local bar (Figure 7.7).



Figure 7.7 Marek on April 20—Attempted MMS to colleague.

The colleague never received the photo. Similarly, Michael often tried to send multimedia messages to his wife and a surprising number of them were never received or were received too late to be useful: “No, the stuff I sent from Texas didn’t arrive. I had to resend it later from the airport, so it didn’t have the desired effect” (Figure 7.8) and “I actually received two photos from my wife.... Because of network stuff I didn’t get it until I got home anyway.”



Figure 7.8 Michael on April 19—Attempted MMS to Natalie.

These participants were trying to engage in uses that may have allowed them to experience the cameraphone as a medium of visual communication. I posit, however, that it would have been difficult to construct an interpretation of the cameraphone as fundamentally communicative when the communicative features of the technology were not sufficiently robust. In order to foster a particular interpretation, service providers and designers will have to ensure that features critical to that interpretation are sufficiently functional.

- Katarina frequently shared photos via MMS with her husband as a way of communicating with him during stressful work days. She sent him photographs of their cats (e.g., Figure 7.9) and garden—subject matter that she thought communicated “the happiness, the home.” At the outset of the study, her husband used his cameraphone to take traditional “Kodak Culture” photographs when he had forgotten his regular digital

camera. Approximately halfway through the study, however, the husband started taking and sharing pictures of gardens and their cats as well. He not only shared these photographs with his wife, he also began sharing them with his younger brother. One certainly cannot make causal attributions between these observations, but if Michael's experiences receiving photographs from his wife influenced his interpretation of the cameraphone as being a more communicative visual medium, these events would point to the significance of individual interpretations in influencing communication practices between communicating dyads.



Figure 7.9 Katarina on May 4—MMS to Michael.

While some dynamism and reinterpretation may plausibly be attributed to interactions in naturally occurring contexts (e.g., the context of the botanical garden), some of the specific instances might also be a result of this study perturbing the natural system of use. If some dynamic reinterpretation did, indeed, result from this study, I do not believe these reinterpretations were enacted for the sake of the study. Because the nuanced changes in interpretation came about within a pattern of use that remained relatively consistent over the course of the study, I believe it is much more likely that this study increased the participants' awareness of their and others' cameraphone use and that this additional social reflectiveness may have played a role in stimulating dynamic reinterpretations.

TOWARD A MULTIFACETED CAMERAPHONE INTERPRETATION

In the study data, I primarily observed reinterpretation in which individuals moved from interpreting the cameraphone as digital camera of last resort to interpreting the digital camera as an omnipresent digital camera or a visual communication medium.

One participant, however, seemed to move much more fluidly among all three interpretations. Katarina moved most fluidly among different genres of cameraphone use, different classes of photographic subject matter and different sharing practices. The language she used to talk about her cameraphone also revealed multiple interpretations:

I don't think I would be able to communicate without my cameraphone because I don't like to use [a] regular camera. I usually ask my husband to do it for me. I guess the cameraphone is the only way I was able to do it.

She notes both the communicative nature of the cameraphone and its role as a regular camera in the same sentence. Of all participants, she seemed most able to hold multiple interpretations at once—the cameraphone as many different things.

This quote also reveals a potentially relevant insight about her experiences with related technologies. Katarina was the only family member who did not have another camera of her own. The couple owned a regular digital camera, but the mutually agreed-upon roles in the household were such that the husband was the only one who used it; he was the designated photographer. As a result, the cameraphone was the only camera that Katarina used or had access to. Because the cameraphone was her only camera, perhaps Katarina defined her experiences with cameras more generally based on this new camera platform—one that is digital, omnipresent, and coupled with a communications medium. Her experience with and interpretation of the cameraphone seems most likely to foreshadow future interpretations of the cameraphone, particularly among populations of individuals who are growing up with a cameraphone as their primary personal digital camera.

I see parallels between this experience of the cameraphone and the experiences of individuals who are growing up without understanding the constraints of film on photographic practice, for example. Or perhaps individuals who are growing up without understanding the experience of sharing one landline phone and one landline phone number with an entire family.

A more speculative outcome of Katarina's cameraphone experience may be an emergent interpretation of the cameraphone as a particularly personal device. Katarina took photographs that allowed her to be more personally reflective, taking pictures, for example, of the flowers in her garden: "I just want to maybe use it as a wallpaper [background on the cameraphone's display]. Or just look at it and improve my bad mood." When she talked about her cameraphone, Katarina said it allowed her to be "independent" and "free." It may be that the combination of a visual and potentially aesthetic medium along with the sociality of a communication medium and the on-hand-ness of a mobile technology allowed Katarina to begin to relate more personally with the technology.

DESIGN IMPLICATIONS

There is often, I believe, a tacit assumption that the design implications of qualitative research should, to varying degrees of concreteness, point to some thing that could be built—one internally consistent technology design. This research demonstrates how the assumption of a "one size fits all" design implication may be entirely inappropriate. Understanding different interpretations of a technology can lead to opportunities for more significant product differentiation in the marketplace. An understanding of the ways in which an interpretation of the cameraphone impacts its adoption and appropriation—whether or not the camera is used, the types of photographs that are taken on the cameraphone, and whether or not these types of photographs are shared—should enable designers to tailor the design of a cameraphone to a class of users with a particular interpretation and related technological needs. Designs impacting software features and functionality, physical form factor, and service plans should all be explored.

An understanding of different interpretations of the cameraphone should also yield an understanding of how those interpretations differ from one another, which should enable designers to better enable users to move from one interpretation to another—a sort of design-based scaffolding. The different interpretations might be between an individual (holding, for example, an interpretation of the cameraphone as a digital camera of last resort) and the designer or industry (holding, for example, an interpretation of the cameraphone as a visual communications medium), in which case the design-based scaffolding might help migrate individuals from one interpretation to another. To scaffold individuals who do not interpret their cameraphone as a visual communication medium, for example, a soft button in the interface might be provided with every incoming MMS that would coach the recipient through the process of crafting an MMS response.

These different interpretations might also exist among individuals, in which case design-based scaffolding could explore ways that interpretations might be more explicitly shared among social networks. Such designs might also help to alleviate communicative misinterpretations that may arise between two individuals who hold different interpretations of a technology and who have different expectations about conventions of use. For example, much as the external text messaging feature³ on Motorola's RAZR2 cameraphone now allows quick, one-touch text templates for responses to text messages, one might also provide quick, one-touch text templates for photo captions that could communicate more of the sender's communicative expectations (e.g., "Just thought you'd enjoy this," "Remind me to tell you about this later," or "What do you think of this?").

BROADER APPLICABILITY OF REMEDIATION

In addition to helping illuminate influences on the interpretations of technologies, an analytic focus on remediation might also be used to suggest hypotheses for or otherwise explore variations in technological adoption and appropriation. It may, for example, be able to provide some insight into cross-cultural differences in technology use. Any potential differences in the

³ <http://direct.motorola.com/hellomoto/RAZR2/experience/>, accessed 5 May 2008

use of multimedia messaging between North America and Western Europe, for example, may, at least partially, be explained by different ecologies of related technologies from which individuals may have drawn to construct different interpretations of multimedia messaging. For example, in 2005, when this study took place, multimedia messaging was used at least once a month by 12% of the North American mobile phone market (A.T. Kearney & Judge Business School, University of Cambridge, 2005a). A similar market penetration (14%) had been achieved in Western Europe in 2004 (A.T. Kearney & Judge Business School, University of Cambridge, 2004). At similar times in the uptake of the same technology, however, the technological ecology looked quite different: in North America, the market penetration of digital cameras was at least 42% and projected to be at 55% by the end of the year (InfoTrends, 2005b) while the market penetration of digital cameras in Western Europe was only reported at 26% (InfoTrends, 2005c). During the same respective time periods, the market penetration of text messaging in Western Europe was at 79% (A.T. Kearney & Judge Business School, University of Cambridge, 2004) while the market penetration of text messaging in North America was at 20% (A.T. Kearney & Judge Business School, University of Cambridge, 2005b). When a technology is brought into different markets with different technological ecologies, individuals might draw from different technologies or from those technologies in differing weights in constructing interpretations of the new technology.

As an analytic lens, remediation should also become increasingly relevant as technologies become increasingly convergent. In the media, the cameraphone is not described as just another computational device; it is "the device that ate everything" ("The device that ate everything," 2005). This increased convergence of technologies brings greater potential for individual users to draw from experiences with a larger breadth of affiliated technologies when constructing the meaning of a technology. An analytic lens of remediation foregrounds individuals' experiences with these many affiliated technologies. With increased convergence and the increased potential for multiple, diverse interpretations comes an increased need to

understand how users are interpreting and reinterpreting these complex technologies.

CONCLUSION

As I noted previously, researchers have documented an amazing breadth of ways that individuals and groups have appropriated cameraphones and other related networked forms of digital photography. At the outset of this paper, I asked what influences the adoption and appropriation of cameraphones. What influences people to use their cameraphones for photographing mundane experiences? What influences people to use their cameraphones for maintaining social relationships? My research, employing an analytic lens of remediation, suggests that the answer lies, in part, with individuals' experiences with related technologies. This analytic lens offers one possible theory-base for understanding the interpretation of technology, foregrounding the ecology of related technologies in the dynamic interpretation and reinterpretation of cameraphones.

In this paper, I presented results from a case study of cameraphone use and identified three different interpretations of the cameraphone. These interpretations were exposed by the relationship between cameraphone use and personal experiences with related technologies. These interpretations influenced whether or not individuals adopted a technology and how that technology was appropriated. The interpretation of a cameraphone as a digital camera of last resort was held by individuals who interpreted this technology primarily in contrast to their interpretation of a regular digital camera as a high-quality image capture device. The interpretation of the cameraphone as an omnipresent digital camera reflected a reframing of the phone's digital camera when always on hand, as with the individuals' experiences with cellphones. Other participants drew from their experiences with forms of networked communication and augmented these types of communicative exchanges with photographs to construct their interpretation of the cameraphone as a visual communication medium.

The three interpretations that I identified in this case study's data may represent individual points in a space of all possible interpretations of the

cameraphone. These three interpretations may also suggest a spectrum or space of interpretations—interpretations constructed by individuals drawing in differing weights from different combinations of affiliated technologies.

Finally, I characterized the dynamic nature of interpretations—continually reconsidered based on direct experiences with the technology or with affiliated technologies as well as indirect experiences with others' interpretations of the technology. As different interpretations of technology reverberated throughout the social network in this case study, individuals' interpretations evolved and their communicative practices evolved. The social interplay among individuals, interpretations, and practices make dynamic, heterogeneous interpretations of technology a compelling object of investigation for understanding trajectories of technology use in computer-supported cooperative work.

CHAPTER 8

EXPLORING SOCIAL & ORGANIZATIONAL RESOURCES FOR THE INTERPRETIVE BRICOLAGE OF PERSONAL TECHNOLOGIES

As the interpretation of technology became a more explicit focus of my research, I wanted to better understand the breadth of resources that individuals might draw from in the interpretive process. Data from this study suggested that a diversity of technical, social and organizational resources were influential in the use and understanding of technology.

INTRODUCTION

The ecology of computational technologies available to consumers is vast and vibrant. The number of personal technologies—mobile phones, digital cameras, digital music players, portable DVD players, and personal digital assistants—available to consumers is ever increasing as new media and networking technologies become viable and affordable on smaller and smaller devices. The ecology of these personal technologies is also quite vibrant—continually shifting and reconfiguring as computational functions and features are combined and re-combined into new hybrid devices.

Consumers are being asked to make sense of these continually changing ecologies of personal technologies. Rarely-read instruction manuals are increasingly being supplemented or replaced by “getting started” leaflets that describe the mechanics of setup but do little to characterize the uses for or nature of the technology. How consumers come to understand or interpret the evolving ecology of personal technologies—how to use these technologies, what to use them for, and more symbolically, what they come to mean—is a critical gap in the knowledge base of human-computer interaction.

Understanding how consumers come to make sense of technology requires exploring a range of resources that individuals might draw from in an ongoing process of interpretive bricolage:

In a process of *bricolage*, [consumers] appropriated, re-accented, rearticulated, or trans-coded the material of mass culture to their own ends, through a range of everyday creative and symbolic practices (Mackay, 1997).

When technology is released into the marketplace, the meaning of a technology is not pre-defined or pre-ordained. Designers and the organizations that manufacture or market technologies may have their own preferred meaning for a technology, but researchers who study the consumption of technology and other cultural artifacts have found that consumers actively and creatively contribute to constructing new meanings for these artifacts (e.g., de Certeau, 1984; Mackay, 1997):

Technologies, like other artefacts, are not merely material or utilitarian, but also symbolic. Rather than being determined by designers and manufacturers and then purchased for what they can do, their meaning, and also their form and function, are shaped by consumers (Mackay, 1997).

The interpretation of technology is a symbolic construction of meaning by consumers who draw from a variety of resources in a synergistic process of interpretive bricolage.

Interpretive Resources

The synthesis of interpretive resources by consumers is characterized by a balance between creativity and constraint (Mackay, 1997). The creativity of consumers that has been the focus of much research in cultural studies is also evident in human-computer interaction research. Interpretive creativity is foregrounded in social scientists' documentation of novel instances of the appropriation of technologies—the use of instant messaging for “outeraction” (Nardi, Whittaker & Bradner, 2000), the use of multimedia messaging for the construction of collaborative narratives (Koskinen, Kurvinen & Lehtonen,

2002), or the use of iTunes as an ad-hoc awareness mechanism (Vaida, Grinter, Ducheneaut, Edwards & Newman, 2005), for example.

Much of the foundational research in human-computer interaction focused on particular resources that constrain interpretation—the *affordances of technology* (Norman, 1988). The affordances of a technology, inscribed in its design, limit the breadth of ways that individuals can come to understand that technology (Mackay, 1997). Ranging from physical features to specific functionality, these affordances, then, are one of the primary resources that consumers draw from in their interpretive bricolage, their process of making sense of technology.

Other related research in human-computer interaction has suggested that people draw from *related technologies and genres* with which they are already familiar when deriving expectations and conventions of use for newer technologies (Vaida, Newstetter & Mynatt, 2002; Yates & Orlikowski, 1992). Similarly, research in media studies has argued that new technologies present themselves in relation to other technologies, both past and present (Bolter & Grusin, 1999). Together, this body of research suggests that the ecology of related technologies is a second resource that consumers draw from in making sense of technology.

Several related areas of research in human-computer interaction suggest the importance of *activity* in how one understands and uses technology. A large body of research in human-computer interaction is united by its theoretical grounding in activity theory and the interrelationships among the individual and the technological tools that are used to accomplish a particular objective (e.g., Kaptelinin & Nardi, 2006). In addition, sociologists of technology have suggested that the surrounding human activity is, in fact, part of the fundamental meaning of the technological artifact (Mackenzie & Wajcman, 1985). Together, this research suggests that activity may also serve as a third resource that individuals draw from in making sense of technology.

Other resources that may be drawn from in the process of understanding technology are less well understood within HCI, particularly the social and organizational resources. In this research, I explore four social and

organizational resources that individuals may draw from in the process of making sense of their technology. I explore two resources that are put forth by the organizations that develop technologies and offer related services—advertisements and pricing plans. I explore one resource put forth by organizations that are not otherwise affiliated with the technology—news stories. Finally, I explore one additional social resource—the habits or experiences of friends, family or colleagues. There are, of course, any number of resources that individuals might draw from when making sense of technology; the four I focus on in this paper represent a sample of salient resources across organizational and other social influences.

In this research, I explore the ways in which individuals selectively synthesize from among these resources. I describe my study of four resources that were drawn from in the interpretation of three personal technologies. I present results characterizing the ways that each resource was drawn from in the interpretive processes. More broadly, I characterize the process of interpretive bricolage for these personal technologies: the creativity and constraint of interpretation, the weighted synthesis of resources and the continuum between symbolic and literal interpretations. I discuss more in-depth the relationship between the interpretation of devices and of the interpretation of data or content on those devices and explore the open question of what resources have influence.

METHOD

I conducted a survey-based study of four social and organizational resources that people draw from in making sense of three different technologies in the vibrant ecology of personal technologies: BlackBerries, cameraphones, and iPods. I recruited respondents via snowball sampling; I both distributed and collected surveys via email. I collected data between October 2006 and May 2007 and employed descriptive statistics and inductive qualitative analysis of the 64 survey responses.

Domain of Study

I selected three technologies for investigation in my study of the social and organizational resources people draw from in coming to understand technologies: BlackBerries, cameraphones, and iPods. I selected technologies that are central to the vibrant ecology of personal technologies, featuring functionality that is continually being reconfigured onto new hybrid devices.

Where possible, I have constrained this study to a specific brand of a technology that would have a unique commercial or marketing identity in order to investigate brand-related organizational resources. While I could not identify a particular instance of the cameraphone that had a unique enough brand or identity to constrain the recruiting, I did constrain the study of mobile email devices and personal digital assistants to the BlackBerry and the study of digital music players to the iPod.

RIM's *BlackBerry* supports email and text messaging and is a "media player, phone, browser, organizer, camera and more"¹. Previous studies of the use of BlackBerries have focused specifically the device's wireless email functionality. Mazmanian et al. identified three conflicting dualities that characterize the use of the BlackBerry's ubiquitous email: the continuity of staying in touch alongside the asynchronicity of interactions with email, the engagement with email communication alongside the withdrawal from face-to-face interactions, and the autonomy of flexibly-timed communication alongside the addiction to and expectations of being increasingly available (Mazmanian, Orlikowski & Yates, 2005).

The *cameraphone* is a device, which, at minimum, combines the functionality of a cellphone and a digital camera. Some research exploring the use of cameraphones suggests that the hybridization of these two technologies may not automatically elicit novel patterns of appropriation (Volda & Mynatt, 2005a). Other research describes some creative new practices, foregrounding emergent new genres of both personal (e.g., Okabe & Ito, 2003) and collaborative (e.g., Koskinen et al., 2002) photography.

¹ <http://www.discoverblackberry.com/>, accessed 18 September 2007

Research on the use of the Apple's *iPod* generally builds on the body of cultural studies research exploring the use of the Sony Walkman (e.g., du Gay, Hall, Janes, Mackay & Negus, 1997), particularly in exploring themes involving the boundaries between the public and the private (Bull, 2006) and the construction of mobile soundscapes (Bull, 2005; Bull, 2006; Nettamo, Nirhamo & Häkkinen, 2006).

Respondents

I recruited respondents via snowball sampling. The demographics of respondents varied based on the technology being studied.

Respondents to the BlackBerry survey included 9 males and 10 females, most older than 30, who had owned BlackBerries for an average of 2 years. Respondents to this survey included attorneys, managers, communications or public relations directors, an academic faculty member, and a systems administrator.

Respondents to the cameraphone survey included 10 males and 11 females, most younger than 40, who had owned cameraphones for an average of 1 year and 10 months. Respondents to this survey included students, attorneys, an academic faculty member, an organist, an account executive, and a stay-at-home mom.

Respondents to the iPod survey included 12 males and 12 females, most younger than 40, who had owned iPods for an average of 2 years and 1 month. Respondents to this survey included students, managers, an academic faculty member, a member of the clergy, a medical consultant, and an organist.

Seven individuals responded to two of the three surveys. One individual responded to all three surveys.

Survey Design and Dissemination

I distributed and collected surveys via email. Surveys took approximately 20-30 minutes to complete and consisted of a variety of multiple choice, short answer, and open-ended questions. I employed multiple choice questions to

gather demographic information such as gender and age. I employed short answer questions to solicit information about the respondents' occupation, how long they had owned the technology, and what particular model they owned. A series of open-ended questions made up the majority and remainder of the survey. Through these questions, I explored four particular resources that individuals might draw from in making sense of their technology: advertisements; pricing plans; news stories; and the experiences of friends, family or colleagues.

In addition to asking specifically about these four resources, I also offered several additional survey questions to provide respondents with multiple opportunities to describe resources I had not anticipated.

For each resource, then, I asked respondents to describe a specific instance of the resource (e.g., a specific advertisement or news story). This instance was used to concretely ground the follow-up questions and allowed me to ascertain each respondent's general awareness of the resource. I, then, asked respondents to explicitly interpret each instance of the resource—what did the respondent think his or her example conveyed about what the organization or individual behind the example believed about the technology. I asked respondents to describe how this belief related to their own beliefs about the technology and, finally, to comment on whether the organizations' or individuals' belief had impacted their use of the technology.

There were several general considerations I took into account when designing these surveys.

Along with other researchers in the field of human-computer interaction (e.g., Sengers & Gaver, 2006), I draw heavily from research in related disciplines like science and technology studies (e.g., Oudshoorn & Pinch, 2003), where empirical studies of technology use have found that different individuals can come to different understandings about the role and meaning of a technology in their life. In my survey design, I allowed individuals to provide evidence of their individual interpretations of technology. In my analysis, I treated each of these interpretations as a legitimate object of

study—whether or not they reflected a designers’ preferred interpretation of the technology and whether or not they were shared among respondents.

Because the interpretive process is not typically a conscious process, I chose to use alternate, more accessible, language in the surveys. Instead of using language about “interpretation,” I used the words “believe” (e.g., What do you think this news story says about what the media believes about BlackBerries? How does this compare to what you believe about your BlackBerry?) Although this word substitution is not wholly equivalent, it was close enough and accessible enough to elicit descriptions of resources and the inferences based on those descriptions that I was interested in understanding.

How people come to understand a technology and what they believe about a technology are highly subjective matters. I designed the surveys in order to elicit data about these subjective beliefs. Not everything that our respondents believed was “technically” accurate. Some readers may find themselves disagreeing with some of our respondents’ beliefs. Some readers may find some respondents’ beliefs to be bizarre or even baseless. However, subjective beliefs are an important object of study in human-computer interaction. What people believe about technology, even if it is technically inaccurate, does, in the end, impact how people use technology and, indeed, whether or not they use the technology at all.

Individuals’ subjective beliefs about technology and the resources they draw from in making sense of technology are not easily observable, if they are observable at all. The nature of the object of study places clear methodological constraints on this research. The survey method I chose to employ allows respondents to describe and reflect on the resources they draw from (or do not draw from) in making sense of technology. The survey method does, however, require retrospective accounting and can be prone to self-report bias. Because of this, I have employed specific survey design techniques to help alleviate bias, for example, grounding questions in specific and concrete examples of respondent-generated experiences. The survey design yielded a substantial amount of data about the social and

organizational resources people draw from in coming to understand technologies, but I do acknowledge that this data, as with all survey data, is retrospective and cannot be perfectly void of self-report bias.

Finally, it is worth commenting on the layer of indirection that I utilized in the survey design. I asked respondents to tell me what they believe others believe. At first glance, this may appear to be a form of speculation generally undesirable in research. This indirection is, however, an essential interpretive step in individuals' understanding. An individual's interpretation of others' beliefs is what that individual will use in making sense of a technology, not what others' might actually believe. This is a claim that has received considerable philosophical attention (e.g., Gadamer, 2005; Wimsatt & Beardsley, 1954).

Data Analysis

I employed different analytic techniques for different forms of data. I aggregated data about the age, gender, occupation, and duration of the technology ownership of respondents in order to descriptively characterize technology-specific subpopulations of respondents. I analyzed open-ended survey data following a multi-stage process. For each technology and resource, I first categorized each response as one of the following:

- *Respondent could not recall an example of this resource².* If a respondent could not recall an example of a resource, the lack of awareness suggests that this resource did not factor highly in his or her understanding of the technology.
- *Respondent described an example of the resource but did not feel that the specific example influenced his or her understanding of the technology.*
- *Respondent described an example of the resource that he/she felt influenced his or her understanding of the technology.*

The quantitative results from this categorization are presented in Table 8.1.

² The survey design specified that if respondents could not recall an example, they should explicitly indicate as such. In this way, I can claim that respondents could not recall an example, in lieu of, for example, a situation in which the respondent skipped the question.

Table 8.1 The recall of social and organizational resources and the influence of instances of those resources on respondents' use or understanding of the technology.

Social & Organizational Resources	BlackBerry	Cameraphone	iPod
Pricing Plans			
Percentage of all recipients who recalled an instance of the resource	37%	67%	79%
Percentage of all participants who felt that instance influenced their use or understanding of the technology	32%	48%	46%
Advertisements			
Percentage of all recipients who recalled an instance of the resource	5%	57%	83%
Percentage of all participants who felt that instance influenced their use or understanding of the technology	5%	19%	46%
News Stories			
Percentage of all recipients who recalled an instance of the resource	74%	71%	63%
Percentage of all participants who felt that instance influenced their use or understanding of the technology	26%	24%	29%
Habits or Experiences of Friends, Colleagues or Family Members			
Percentage of all recipients who recalled an instance of the resource	68%	71%	79%
Percentage of all participants who felt that instance influenced their use or understanding of the technology	42%	29%	33%

For each of these categories of response and each social or organizational resource, I, then, analyzed the data to characterize each resource's interpretive influence more broadly across all three technologies. I analyzed responses within the following categories, each corresponding to a follow-up survey question: the genre of resource examples described by respondents, the types of beliefs inferred (e.g., symbolic or literal), and respondents' rationale for how or why an instance of a resource did or did not influence their understanding of the technology. I present an overview of the results of this analysis in the summary of data.

Finally, I inductively coded all of the open-ended, qualitative data for emergent themes (e.g., influences on how respondents came to understand content-related constructs) across all technology and resources. I present the results of this analysis in the discussion.

SUMMARY OF DATA: RESOURCES' INFLUENCE ON THE USE OF TECHNOLOGY

Respondents' ability to recall an example of a resource varied dramatically, from 5% of BlackBerry survey respondents able to recall an advertisement to 83% of iPod respondents able to recall an advertisement (Table 8.1). For the respondents of each technology survey, a different resource was most often able to be recalled: news stories were most often able to be recalled by BlackBerry survey respondents; news stories and the habits or experiences of friends, colleagues, or family members, by cameraphone respondents; and advertisements, by iPod respondents.

All four social and organizational resources were reported to influence the use of technology for at least one respondent of each survey. For the respondents of each technology survey, a different resource was most commonly reported to have influenced the use or understanding of the technology: the habits or experiences of friends, colleagues, or family members was most commonly reported to have influenced BlackBerry survey respondents; pricing plans, to have influenced cameraphone respondents; and both pricing plans and advertisements, to have influenced iPod respondents.

In the following sections, I provide an overview of the data about each of these four social and organizational resources.

Pricing Plans

The influence of pricing plans on respondents' use of technology was most commonly related to whether features of the technology were or were not included in the flat rate of the pricing plan. Respondents often specified which services were covered and which services were not, in general, explaining how they felt free to explore the use of services covered under

flat-rate plans but tried to find work-arounds to pay-per-use services, for example:

The availability of an unlimited data plan...has freed me to use [my BlackBerry] in any way that I see fit. For example, looking up restaurants on Google maps, checking web-based email, checking up on the news, etc.... If I were paying per usage, I would be much less inclined to do these things [B14³].

Other participants confirmed that pay-per-use services were often not used:

...[service providers] think of [MMS] as a premium service that they can charge their customers extra for.... If it were included, I might be inclined to use it more.... Because they want to charge extra for it, I don't see the point in using that service [C17].

In contrast to the relatively all-or-nothing perspective reflected above, several iPod respondents focused their discussion on the choices afforded by the price structure in the iTunes Music Store, the ability to either purchase music by the song or by the album:

[This choice] reflects Apple's belief in the flexibility and control an iPod gives its user. iPods allow you to take your music anywhere and arrange the music in any order.... I make use of playlists to customize the way I listen to my music and I usually buy individual songs rather than entire albums [I11].

In general, respondents who did not believe that their pricing plan influenced their use either (a) had established practices for using the technology that did not depend on fee-based services—using their cameraphone to share photos face-to-face using the device's display instead of using MMS, for example, or listening to free podcasts on their iPod instead of paying for digital music—or they (b) believed other resources were more important influences than the cost of services—BlackBerry and cameraphone survey

³ I refer to respondents anonymously, first by a letter specifying the technology under investigation (B for BlackBerry, C for Cameraphone, and I for iPod) and then by a per-technology respondent number.

respondents often cited “practical” issues (e.g., “the picture quality stinks and the messages shared...don’t work reliably” [C13]), while iPod respondents often cited Apple’s digital rights management policy as reflecting beliefs about technology with which they did not agree.

Advertisements

Respondents who believed the advertisement they recalled had influenced their use of the technology generally described ads from which they inferred a belief about technology that resonated with their existing beliefs and reminded them about functionality that they already used.

Many respondents who did not believe the advertisement they recalled had influenced their use of technology described ads foregrounding potentially interesting uses for the technology that the respondents felt were overshadowed by other factors such as the price or usability of the associated functionality. Respondent C3 described an advertisement in which “a person was taking a picture of a dog sitting in the driver’s seat of a car and sending a message saying ‘wonder where he’s going?’” Respondent C3 continued:

The ad suggested that cameraphones were good for capturing funny moments where you don’t have a regular camera available and sharing them with people you love.... Yes, they would be fun for sharing funny pictures with friends and family, but the quality of pictures taken combined with the obscene price of cellphone data transfer makes me not really care enough to use a cameraphone.

Respondents who did not believe the advertisement they recalled had influenced their use of the technology also interpreted these ads as conveying a symbolic interpretation of the technology to which they did not identify, for example: “iPods are...for people who identify themselves as ‘cool,’.... I purchased and use mine for its functionality (I’m resigned to my uncoolness and don’t believe an iPod or anything else will change it)” [I11].

News Stories

The influence of news stories on respondents' use of technology was most commonly related to the genre of news story that was recalled. Respondents who believed that the news story they recalled influenced their use of technology described news stories that featured (a) general warnings about personal safety and well-being (e.g., reports of people being injured while listening to iPods on which the volume was turned up too loudly) or (b) the social or lifestyle implications of technology (e.g., a news story about "executive women who are now stay-at-home moms and how they've taken their BlackBerry into their family lives" [B17]).

Respondents who did not believe the news story they recalled had influenced them generally described news stories that (a) they felt were mostly hype, reporting for example, a possible shutdown of the BlackBerry email servers that they did not feel would be as significant as the media suggested, or stories that (b) reported about very specific subpopulations of users, contexts of use, or uses that respondents did not believe were applicable to them, for example, "I am not very actively spiritual...I have not been tempted to listen to religious podcasts" [I19].

Habits or Experiences of Friends, Colleagues or Family Members

Respondents who believed the habit or experience of a friend, colleague or family member influenced their use of the technology almost without exception described a practice they had heard about or seen that they then adopted. One iPod respondent, for example, reported that a friend had a habit of listening to her iPod at work to tune out distractions in the office and that this observation influenced her to use her iPod in a similar fashion [I16].

Some respondents also described a habit or experience of a friend, colleague, or family member that was a counter-example of how they wished to use their technology. One BlackBerry respondent described her boyfriends' habit of constantly checking his BlackBerry:

My boyfriend...has the attention span of a gnat with the [BlackBerry]. He is always checking it for alerts, updates, etc....

It has made me check mine less when among friends and family, and be more aware of how annoying the constant checking is [B12].

Respondents who did not believe the habit or experience influenced their use of the technology, in general, either described others' uses of the technology that (a) were consistent with how they already used their technology, in which case they did not feel that these others' uses influenced their use, (b) required features that the respondents' technology did not have (e.g., a larger display size or a higher resolution camera), in which case the respondents did not feel that others' habits or experiences were able to influence their use, (c) were contingent on contexts in which the respondent did not find him- or her-self, for example, "A friend will not workout unless he has his iPod. I don't workout, so there's no relation" [I10], or (d) reflected an interpretation of the technology with which they disagreed (e.g., using an iPod frequently as a "status symbol" [I5]).

Other Resources

I offered multiple opportunities in the survey for readers to describe instances of other resources they felt had influenced their use of the technology.

Respondents identified several interpretive resources with which the field of HCI is already familiar:

- The affordances of the technology (e.g., "The greatest influence was the memory size. I really stopped using the camera as much when I reached the point that I need to delete something to take a new picture" [C2]).
- Other related technologies (e.g., "I think my previous use of my old mp3 player...dictated how I currently use my iPod" [I23]).
- The nature of the activity (e.g., "My job position has been the greatest influence. I'm a director...of communications. The former means I'm in a senior enough position to have to be on call most of the time. The latter speaks for itself, I hope. The BlackBerry is integral to my responsibilities" [B12]).

Respondents also reported two unanticipated, additional resources: third-party technologies and online forums.

- Third-party technologies (e.g., “Bose. I have the docking station in my kitchen and usually keep my iPod plugged into it. Great when cooking...” [I22] or “The introduction of podcasts...has had the greatest influence on how I use my iPod. Probably 80% of the time I’m using the iPod is to listen to podcasts, from sources such as PBD, NPR, TWIT.TV, Wall Street Journal, and various independent podcasters” [I6]).
- Online forums (e.g., “These forums helped me when I first got the device so that I could learn how to use it most effectively” [B14]).

CHARACTERIZING THE INTERPRETIVE BRICOLAGE OF PERSONAL TECHNOLOGIES

A Balance between Creativity and Constraint

As suggested by cultural studies research (e.g., Mackay, 1997), the interpretive bricolage reflected in the data was indeed characterized by a balance of creativity and constraint. The data suggests, however, that no one resource is drawn from solely for creativity or constraint. Technology, as suggested, did act as a constraint: when cameraphone respondents observed friends’ use of cameraphone features that their cameraphones did not have, respondents reported that those observed practices did not influence them. And yet, technological features were also a resource for creativity. Third-party technologies were a particularly creative resource for several iPod respondents whose use of the technology changed considerably with the release of the Bose docking station or third-party podcasts. Pricing plans also served as a resource both for creativity and constraint, most dramatic in the division between all-inclusive and per-use pricing plans, with all-inclusive plans often stimulating creativity and exploration of features and services that might not otherwise be used and per-use plans often constraining use, in some cases as if those features did not exist.

An Active, Weighted Synthesis of Resources

The data also reflects the active, weighted synthesis with which individuals drew from multiple resources. It was common within the data for reflections about a particular resource to refer to the relative importance of that resource among other resources. The potential influence of a Blackberry pricing plan, for example, was trumped by usability issues with the technology, itself. The potential influence of news stories about the iPod or the iPod habits or experiences of friends, colleagues or family members were less influential than the symbolic interpretation of the technology that those resources embodied.

Respondents also engaged actively with the interpretations reflected in these others' resources. They did not blindly accept friends', families', colleagues', the news media's, service or content providers', or technology companies' interpretations of the technology. Multiple respondents [B1, B14, B15], for example, drew inferences about RIM's dual home-business interpretations of the BlackBerry, based both on feature sets as well as on pricing places. One participant reflected on and rejected this dual home-business interpretation:

There seems to be a belief that the market is split between business and home users. For example, BlackBerry has been maintaining two lines of their devices, one with full QWERTY keyboards and one with the suretype keyboards. The suretype keyboards are setup with more multimedia features, a camera, etc. The QWERTY keyboards have less of these "entertainment" features. I think that the divide between business and personal use is less distinct than the device portray... [B14].

Similarly, several cameraphone survey respondents described news stories in which "your average Joe on the street" [C13] took cameraphone photos that were used to document crisis events. One respondent did not personally identify with the "average Joe" pop-journalist interpretation, responding that "it's never going to be me reporting it like that" [C16].

A Continuum between the Symbolic and the Literal

Previous research has suggested that interpretations are a symbolic construction of meaning (e.g. Mackay, 1997). In this data, both the interpretations of resources and the expressed rationale for why those resources did or did not influence respondents existed on a continuum between the symbolic and the literal. Most iPod survey respondents, for example, described an advertisement in which silhouettes of people danced against brightly colored backgrounds. This ad was variously interpreted, however. Some interpretations were more symbolic: "The bright background seems to symbolize the idea that iPods are fresh and modern" [I17] or "iPod is a lifestyle and a statement...a symbol of young and contemporary" [I19]. Other interpretations were more literal: "[iPods] make you wanna dance" [I1] or "Apple thinks I'm on drugs, or at least should be, when I dance with my iPod" [I2]. Likewise, individuals engaged with resource examples in both symbolic and literal ways. Two BlackBerry survey respondents reflected in different ways about their own interpretations of the same news story about an outage of BlackBerry service. One respondent engaged her interpretation of the news story on a more symbolic level: "I don't believe that Blackberries have become an essential business tool. I think that BlackBerries are nice to have, not an essential communication tool" [B11], whereas another respondent engaged her interpretation of the news story on a more literal level: "I do not feel as strongly about needing email access at all times as do many other people" [B9].

An Extension from the Interpretation of Devices to the Interpretation of Data and Content

While I designed this study to focus on the resources drawn from in making sense of devices, data from all three surveys suggested that there are interactions among the interpretation of devices and the interpretation of related data or content, in its various multimodal forms.

One BlackBerry survey respondent [B1], for example, struggled to reconcile her understanding of "data" with what she inferred to be her service provider's understanding of "data." She believed that any information sent

via her BlackBerry (not including voice-based phone calls) was data. Her service provider seemed to have a different understanding of data as revealed by her pricing plan. This respondent had a flat-rate pricing plan for all data, but the pricing plan specifically excluded text messages.

Several cameraphone respondents reflected on the meaning of the photograph in the context of their cameraphones, whether it was a “real” photograph or a “throw-away” photograph [C12] or whether it was a photograph at all:

[The cameraphone makers] also seem to assume that people will share [photos] through MMS or some similar phone-based interaction, and that people won't want to move images off their cell phone any other way—because otherwise it wouldn't be so irritatingly hard to get to the MMC card inside the phone.... It's as if they see cameraphones as devices for making MMS with, rather than devices for making photographs with [C5].

Several iPod respondents also reflected on the meaning of the media content used with their device. Some respondents discussed the influence of customizable playlists or the shuffle feature on their understanding of music. Respondent I19 suggested that the iTunes Store's pricing structure suggested the loss of integrity for the meaning of music as album:

[Apple believes] that albums are not concepts -- that they can be chunked into discrete entities. This is very interesting...it would be completely weird to buy just one of Vivaldi's Four Seasons—'I'll take Winter, please' or one of the three components that make up Winter, 'I'll take Winter, but sod Largo, that was always totally boring.' Makes no sense to me. But, I think (I can't speak for Britney Spears) that a lot of pop artists also have a notion that the album has an order and that the tracks are not just individual songs but together complete the album concept. iTunes...destroys that notion with this modular pricing structure.

Each of these examples suggests the strong influence of interpretive resources not only on the devices but on the data and content on those devices, as well. Scholars who study the interpretation of texts suggest that individuals interpret texts by moving back and forth between interpreting the whole text and interpreting smaller parts of the text in light of the whole (Jasper, 2004). These data suggest that a corollary interpretive process is at play in the interpretation of technology, with individuals moving back and forth between interpreting the whole technology (the device) and interpreting its parts (the data or content).

AN OPEN QUESTION OF WHY RESOURCES HAVE INTERPRETIVE INFLUENCE...

Understanding the process of interpretive bricolage seems to begin with understanding that not all resources are interpretively available to all individuals. To borrow an analogy from signal processing, only resources to which the individual is exposed or has attended are interpretively available signals; other resources are just noise. I asked respondents to recall an example of each resource in order to understand the extent to which different resources might be interpretively available. I was surprised by the large variability both within and among technologies of this exposure or awareness, from 5% recall in some cases to 83% recall in other cases. BlackBerry respondents recalled examples for only 46% of all resources while iPod respondents recalled examples for an average of 76% of all resources. Clearly, there will be more prevalent advertising for some technologies than others, a greater number of news stories about some technologies than others, and some social networks will be more flush with some technologies than others. The issue of what makes resources interpretively available is an open question.

In addition to the variability of interpretive availability among classes of resources, these data also emphasize the influential variability among specific examples of a resource. Reflections on the influence of a particular example were in some cases highly dependent on the example that was recalled. There was a clear division, for example, in whether Blackberry

survey respondents felt that the recalled news story influenced their use of the technology. This division correlated with the genre of news story that was recalled. Because I only asked respondents to describe one example of each resource, I cannot assume that other examples of that resource would have the same influence or lack thereof. One respondent [I6], in fact, provided three examples of news stories about the iPod, one of which he felt influenced his use and two of which he felt did not.

Finally, I am all too cognizant that resources can influence individuals even if they do not claim the resource influenced them. 74% of BlackBerry survey respondents recalled a news story about BlackBerries but only 26% of BlackBerry survey respondents believed that news story influenced their use of the technology. Understanding why individuals did not believe those resource examples influenced them is also an open question as is understanding the role of these more subconscious influences.

CONCLUSION

My research provides initial data characterizing the role of social and organizational resources in the process of interpretive bricolage for personal technologies. Beyond the technological affordances, the related technologies, and the activity-based influences with which the field of human-computer interaction is most familiar and adept at working with methodologically, there are other resources that strongly influence individuals' understanding and use of technology.

The creative influence drawn from the resource of third-party technologies is a particularly compelling take-away for the field of HCI. As other individuals or organizations envision new uses for and understandings of a technology, they produce additional software, hardware, or content to expand the meaning of the original device in ways that seem to both appeal to additional users and to inspire new appropriations of the technology from existing users. This finding suggests that there is value in conceptualizing and designing emerging technologies as platforms for third-party development and in providing resources for third parties to fulfill their important role in the ecosystem of interpretive resources.

Additionally, there are both strong creative and constraining influences drawn from pricing plans with related content or service providers. In many cases, the inclusion or exclusion of features in service plans was as strong a creative or constraining influence as the technology, itself. Features and functionality that were not included in flat rate pricing plans or cost per-use, for example, were frequently spoken of as if they were not present in the design of the technology at all. The relationships between those who develop the technology and those who provide content or services for the technology are critical. Designers would be well served to consider what value a feature has in both the presence and absence of paid content and services—how can a cameraphone be designed, for example, so that the camera is easy and compelling to use even if the user opts not to pay service providers for multimedia messaging?

In this chapter, I have characterized the way that people draw from multiple resources to interpret the meaning of technology in the context of their daily lives. Some of these resources may be drawn from explicitly; some, implicitly. And significantly, inferences drawn from different resources may not be consistent or in agreement with each other. Furthermore, some of these resources may be outside of the traditional scope of HCI design. Interpretive inferences drawn from a pricing plan, for example, may render well-designed MMS functionality irrelevant. Policies regarding digital rights management may discourage use more than well-designed user experiences encourage use. The response from the HCI community should not be to metaphorically throw up our hands in futile dismay but to articulate a larger agenda surrounding the intended user experience of consumer technologies.

More than a decade ago, the field of HCI needed to make the case in industry that their expertise was about much more than rendering acceptable images on the screen; it was about understanding user needs that should be driving design activities. A similar challenge currently presents itself for our field—to articulate that our expertise extends beyond fitting design to user needs to understanding the ecosystem of resources that users may draw from in conjunction with technology use. This is not an intractable challenge. Some

companies have shown great success when paying explicit attention to many of the social and organizational resources users brought to bear on their interpretations of technology (du Gay et al., 1997).

In this research, I have provided evidence of the influence of various social and organizational resources on the use and interpretation of technology. I have provided initial insight into how these resources can both complement and contradict the design choices embedded in the artifact, itself. More than a decade ago, the challenge was to argue that HCI expertise should be brought to bear throughout the design lifecycle; the challenge now is to argue that HCI expertise should be brought to bear throughout the organization, wherever the use and interpretation of the technology is at stake.

PART 3
SYNTHESIZING A TECHNOLOGICAL HERMENEUTIC

CHAPTER 9 ON TECHNOLOGICAL INTERPRETATIONS

INTRODUCTION

Broadly speaking, there are two traditions into which theories of interpretation fall: the normative and the philosophical. Until the 19th century, hermeneutics was primarily normative; hermeneuts laid out prescriptive methods for how texts should be interpreted. One of the most important of the early hermeneuts was Augustine, bishop of Hippo, who set established rules for his normative hermeneutic including, for example, that a reader must be in the proper disposition before undertaking interpretation and that a literal interpretation of text is always preferable to a figurative interpretation (Grondin, 1994). The second tradition within hermeneutics is philosophical hermeneutics or phenomenological hermeneutics, which has taken on the task of “analyzing the originary phenomenon of interpretation [and]...shows how interpretation is defacto practiced” (Grondin, 1994). The hermeneutic I begin to unfold here is in the latter tradition, drawing from a variety of empirical studies to characterize how people interpret technology.

What can we say, then, about how people interpret technology? What influences an individual’s interpretation of a technology? What is the general character of technological interpretations?

INFLUENCES ON THE INTERPRETATION OF TECHNOLOGY

The history of hermeneutics paints a broad and varied portrait of interpretive influences. At different periods in history and by different hermeneuts, different interpretive influences were considered to be more or less important and sometimes more or less heretical (Jasper, 2004). Some hermeneutic scholars have developed their own approaches to hermeneutics to take multiple different interpretive influences into account (e.g., Schneiders,

1999). This has been my approach to understanding technological hermeneutics—exploring many potential contributing interpretive influences. Here, I discuss two influences on the interpretation of technology that were each foregrounded across the empirical basis of this work:

- the individual's experiences with related technology, and
- interactions with others' use and understanding of the technology.

The Individual's Experiences with Related Technology

Bolter and Grusin argue that all media is constructed in relation to other media (1999). Analog photography was interpreted with respect to painting and vice versa. Computer games were interpreted with respect to arcade games and vice versa. Computer graphics were interpreted with respect to film and vice versa. The linguistic record also provides evidence of these relationships between new and existing media. As people come to make sense of new technologies, they frequently do so by explicitly drawing from the linguistic cues of previous technologies—refrigerators, for example, were initially referred to as “ice boxes” (Nunberg, 2004).

The empirical basis of this research supports the claim that individuals draw from their individual experiences with related technology when constructing interpretations and reinterpretations of technology. One iPod survey respondent expressed this connection most explicitly: “I think my previous use of my old mp3 player...dictated how I currently use my iPod” [I23].

The ecology of media and technologies that people draw from in constructing interpretations of technology can be broader than a previous version of a similar device, however. In the study of cameraphones, participants held three different interpretations of the technology, each characterized by different relationships with related technologies. The interpretation of a cameraphone as a digital camera of last resort was held by individuals who interpreted this technology primarily in contrast to their interpretation of a regular digital camera as a high-quality image capture device. The interpretation of the cameraphone as an omnipresent digital camera reflected a reframing of the phone's digital camera when always on hand, as with the

individuals' experiences with cellphones. Other participants drew from their experiences with forms of networked communication and augmented these types of communicative exchanges with photographs to construct their interpretation of the cameraphone as a visual communication medium.

The influence of related media on the construction of technological interpretations can also be seen in studies of instant messaging. Transcripts of instant messaging communication provided evidence that conventions from both written and verbal communication were at play in this medium (Volda, Newstetter, & Mynatt, 2002). Like written communication, for example, instant messaging supported a persistent record of communication and was frequently attended to as circumstances allowed. But like verbal communication, instant messaging was nearly synchronous and afforded more casual use of grammar.

Interviews with individuals who used instant messaging revealed that the evidence found in instant messaging transcripts mirrored their perceptions, as well. These individuals talked quite explicitly about co-opting existing conventions from other communicative media to inform their expectations about and interpretations of instant messaging. Different individuals, however, drew on assumptions about different media, constructing different interpretations of instant messaging. One group of individuals believed that conventions from email or written communication applied to the use of instant messaging, for example:

P10: our email can be monitored. people operate
 under that assumption. i just don't see why IM
 is so different¹.

Another group of individuals believed that conventions from face-to-face or verbal communication applied:

P8: I would hope they're similar to rules applied
 to face-to-face conversations

¹ The following transcripts are from unpublished interviews carried out over instant messaging. The formatting of those instant messaging exchanges along with idiosyncrasies of language that are common to communication over instant messaging have been preserved. The findings from these interviews led to the study presented in Chapter 5.

P8: for example if I told you something negative about my manager, I would expect you not to turn around and tell my manager I said so

P8: I would expect that of a f-t-f conversation as well

P2: if you would have closed the office door or whispered when you had the conversation in person, you shouldn't be saving or sharing it. if you would have had the conversation with your grandmother sitting beside you, it's probably fine to share it

A broader and more historical view of the affiliational ecology of new technologies also reveals the potential breadth of related media and technologies that can play a role in interpretation. Analysis of the use of photo-enhanced instant messaging revealed appropriations that hearkened back through various possible genealogical lineages to media spaces, comics, graffiti, Impressionist painting, the Bayeux tapestry, religious iconography, and even cave paintings (Volda & Mynatt, 2005b).

Interactions with Others' Use or Understanding of the Technology

Because technologies are multiply interpreted, it is all the more likely that people are exposed to or interact with others who hold different interpretations of a technology. The circuit of culture foregrounds a variety of cultural processes in which various stakeholders are likely to insert reflections or embodiments of their interpretations into the socio-technical dialogue (du Gay, Hall, Janes, Mackay & Negus, 1997; Mackay, 1997). The empirical basis of this research suggests that interactions with others' use or understanding of the technology and the correlate inferences about their interpretations of the technology also influence how people interpret and reinterpret technology.

Individuals infer organizations' interpretations of technology from pricing plans, advertisements, news stories, and the technology, itself. These inferred interpretations can influence individuals' personal interpretations of technology. Some BlackBerry, Cameraphone, and iPod survey respondents believed that service providers' beliefs about technology, communicated via

pricing plans, had influenced their use or understanding of the technology. Pricing plans were both a creative and constraining influence on interpretation, with all-inclusive plans often stimulating creativity and the exploration of features and services that might not otherwise be used and per-use plans often constraining use, in some cases as if those features did not exist. Some BlackBerry, Cameraphone, and iPod survey respondents believed that organizations' beliefs about technology, communicated via advertisements, had influenced their use or understanding of the technology. These individuals described advertisements in which the inferred interpretation of technology resonated with their own beliefs about technology and reminded them about functionality that they already used. Some BlackBerry, Cameraphone, and iPod survey respondents believed that the news media's beliefs about technology, communicated via news stories, had influenced their use or understanding of the technology. These individuals described two general classes of influential news stories including stories that warned about personal safety and well being with respect to technologies and stories about the social or lifestyle implications of technologies. And finally, a number of participants noted that inferences about organizational interpretations of technology were drawn from the technology, itself—its features and services. Individuals inferred organizations' beliefs about who should use the technology and what they should do with the technology. Respondents actively and critically reflected on these interpretations, rarely, if ever, accepting them outright and frequently drawing from other resources to interrogate these organizational interpretations in light of other interpretive resources.

Individuals also engaged with other individuals' interpretations of technology through others' use of the technology. Some use might be observed or overheard secondhand. Some BlackBerry, Cameraphone, and iPod survey respondents believed that a specific habit or experience of friends, colleagues, or family members had influenced their use or understanding of the technology, often observing a particular way of using a technology and either deciding to use the technology in that way or reflecting that one

should try to avoid using the technology in that way, particularly if the habit observed was thought to be annoying.

Others' use of the technology was also experienced firsthand. Because of the dyadic nature of much computer-mediated messaging, there may be fewer opportunities for exposure to others' interpretations of the technology through use than in larger-scale computer-mediated communication such as online forums or bulletin boards (Vaida et al., 2002). Even so, we did observe instances of participants interacting with other participants whose technological interpretations were likely different than their own. In the study of cameraphones, there were several examples of multimedia messages that were likely sent from an individual with one interpretation and were received by an individual with another interpretation. The communicative disconnect that occurred between the sender and receiver highlighted the distinctions between interpretations. The elder son Michael, for example, sent his wife, Katarina, an image of some landscaping. He likely viewed his cameraphone as an omnipresent digital camera and meant for the photo to be a conversational placeholder for a later discussion. His wife, on the other hand, frequently viewed her cameraphone as a visual communication medium and puzzled over what her husband's communicative intent might be. Instant messaging transcripts also foregrounded distinctions between individuals' interpretations of technology. An analysis of one transcript, for example, suggested that the two co-communicants had differing expectations about what one's availability should be when using instant messaging, with one set of expectations likely drawn from the conventions of face-to-face communication and another set of expectations likely drawn from the conventions of written communication.

THE CHARACTER OF TECHNOLOGICAL INTERPRETATIONS

The empirical basis of this research more generally suggests that interpretations of technology are (a) dynamic and evolving and (b) hybrid and synthesized constructions.

Dynamic and Evolving

Gadamer's philosophical hermeneutic characterizes a highly dynamic process of interpretation, always changing as the context of the interpreter changes with respect to the context in which the interpreted artifact was created (2005). The circuit of culture is a model in which the interpretation of cultural artifacts is anticipated to be constantly evolving based on the interplay of five major cultural process and the various interpretations of stakeholders (du Gay, et al., 1997; Mackay, 1997). Bolter and Grusin argue that media are constantly changing in response to the remediation of other media (1999). The empirical basis of this research supports the assertion that interpretations of technology are dynamic, as well.

The most succinct and episodic examples of this dynamic come from the study of cameraphones. Over the course of the study, participants reinterpreted the cameraphone and constructed new meanings for the technology based on their ongoing accumulation of experiences with it. In the context of a botanical garden, the younger son recalled a moment in which he reinterpreted his cameraphone as a visual communication medium. Accounts of ongoing interactions between the elder son and his wife suggested that the elder son's interpretation of his cameraphone may have changed after being exposed to his wife's very different interpretation of her cameraphone.

The dynamic nature of interpretation also comes to the fore in the study of photo-enhanced instant messaging. As participants communicated with each other, they constructed new interpretations of the new medium—photo-enhanced instant messaging as visual narrative or photo-enhanced instant messaging as emotionally amplified messaging, for example. It was not the case, however, that the interpretation of this new medium started "from scratch" in some manner obviously distinct from other study participants' evolving interpretations of preexisting technology such as cameraphones. In both cases, individuals appear to have drawn from experiences with related media and technologies in interpreting and reinterpreting their technology, whether the technology had already been in their hands for over a year or

whether they were just beginning to use it. The similarity in grounding between the evolving interpretation of new and existing technologies supports the hermeneutic claim that interpretation is a cyclic process and an example of the “chicken-or-egg” conundrum (Jasper, 2004). Which came first, the technology or the interpretation? Neither and both. Interactions with technology provide ongoing resources for continued interpretive activity—from technology to interpretation, from interpretation to technology, and back again.

Hybrid and Synthesized Constructions

Interpretations of technology are also hybrid constructions. First and most literally, many of the technologies studied were hybrid technologies and the interpretations of these technologies drew strongly from each of their constituent functionalities.

The cameraphone is a relatively straightforward example of a hybrid device. In its most basic form, a cameraphone is a heterogeneous entity consisting of a cellphone and a digital camera. Some interpretations of the cameraphone (e.g., the cameraphone as a ubiquitous digital camera and the cameraphone as a visual communication medium) relied more strongly on its affiliation with the ubiquity or communicative nature of the cellphone, while other interpretations relied more strongly on its affiliation with the digital camera (e.g., the cameraphone as a digital camera of last resort).

The particular networked service supported on most cameraphones, multimedia messaging, is, itself, a hybrid medium, merging the functionality of computer-mediated messaging systems with photography. Appropriations of multimedia messaging reflect both of these constituent parts. Van House, Davis, Ames, Finn & Viswanathan have documented the use of multimedia messaging for personal and group memory (2005), a use that was previously attributed to film photography (Chalfen, 1987). Van House et al. also have documented the use of multimedia messaging for maintaining social relationships, a use that had previously been attributed to earlier forms of computer-mediated messaging (Nardi, Whittaker & Bradner, 2000). People who used multimedia messaging seemed to draw directly from their

experiences with two constituent technologies; they seemed to use MMS a little like they used photography and a little like they used text messaging.

Understanding hybrid interpretations in the context of a medium that is hybridized and also built on top of a platform that is fundamentally hybridized yields permutations of relatively obvious affiliations that influence how people may use technology. But there are other reported uses of multimedia messaging that remain unexplained by these affiliational roots. The use of multimedia messaging for collaborative storytelling, for example (Koskinen, Kurvinen & Lehtonen, 2002), does not seem to be adequately explained by the genealogical roots of messaging, photography, cellphones, or digital cameras. The hybrid nature of interpretations extends beyond the direct affiliational roots of the technology, itself.

Like multimedia messaging, photo-enhanced instant messaging draws from the affiliational roots of text-based messaging and digital photography. A focus on one of the two affiliational roots, photography, leads to a multidisciplinary body of research on people's use of photographs. In the 1970s, Susan Sontag published a collection of essays about the meaning of photography and its use, for example, to confirm experience and enhance reality, to confer importance and beautify, and to take possession of things seen and places visited. Sontag's collection of essays chronicled the history of photography and particularly its most influential professional photographers (1977). About ten years later, anthropologist Richard Chalfen published an account of a more amateur, "home mode" photography, part of what he calls the "Kodak Culture." Within this Kodak Culture, people photograph newborn babies, children blowing out candles on their birthday cakes and sitting on Santa Claus' lap at Christmas. They photograph grown children at proms, graduations, and weddings. And then those who have graduated and married photograph their vacations until they, too, have children and can start the cycle of the Kodak Culture again (1987).

But photography is also more than an art form—either a professional art form (Sontag, 1977), a middle class art form (Chalfen, 1987), or a middle-

class art form emulating a professional art form (Bourdieu, 1990).
Photography is a medium with inherent flexibility:

Although photography generates works that can be called art—it requires subjectivity, it can lie, it gives aesthetic pleasure—photography is not, to begin with, an art form at all. Like language, it is a medium in which works of art (among other things) are made. Out of language, one can make scientific discourse, bureaucratic memoranda, love letters, grocery lists, and Balzac's Paris. Out of photography, one can make passport pictures, weather photographs, pornographic pictures, X-rays, wedding pictures, and Atget's Paris (Sontag, 1977).

It is the inherent flexibility of this medium that makes understanding the hybrid interpretations of photo-enhanced instant messaging more complex than understanding the use of instant messaging and the use of photography as two constituent parts. In photo-enhanced instant messaging, people can take and share photographs nearly-synchronously and chat at the very same time. They can interleave photographic messages with text messages in instant messaging exchanges. In the study of photo-enhanced instant messaging, people did not merely take and share photographs. They did not merely talk about photographs they had taken and shared. The photographs were talk. And in being talk, themselves, the photographs were used in ways that no one had studied before (Volda & Mynatt, 2005b).

To understand the diversity of interpretations of photo-enhanced instant messaging, then, it is not enough to understand it as a hybrid of instant messaging and photography. The photograph, as traditionally understood, is not sufficient for grounding an understanding of the influence of photography on instant messaging. To understand the photograph as talk, one must turn to the broader domain of visual communication, from cave paintings to comics and from graffiti to religious iconography. The many ways that people have communicated with images are the larger ecology from which the interpretation of photo-enhanced instant messaging is constructed. Multiple

affiliational roots are drawn from this historically rich ecology and brought to bear on the use and understanding of photo-enhanced instant messaging.

The hybrid nature of interpretation is not limited to technologies that are explicitly hybrid, either. Multiple affiliational roots are drawn from in constructing interpretations of other technologies. In one of my first interviews about instant messaging, I asked someone why he used instant messaging. This is what he said:

I use instant messaging because it feels immediate, but I don't have to devote my immediate attention to it... I can ask people things...get responses right away. I can feel like I am having a conversation but I don't have to be restricted...to drop everything else just to have that conversation. I can do other stuff, too.

- "Eric" (qtd. in Volda et al., 2002)

This interviewee characterized instant messaging as being nearly-synchronous but able to be attended to when opportune. As it turns out, the former characteristic, being nearly synchronous, is a characteristic shared with most verbal communication; the latter, able to be attended to when opportune, with most written communication. Implied in this interviewee's response was the surprising finding that instant messaging was so valued because of its unique niche as a hybrid of verbal and written communication (Volda et al., 2002). Instant messaging was a little like verbal communication—a little like chatting face-to-face around school lockers or at the office water cooler. Instant messaging was also a little like written communication—a little like email. People drew expectations about instant messaging based both on their expectations about written communication as well as their expectations about verbal communication. People who used instant messaging drew from two affiliational roots—from their experiences and expectations about verbal communication and from their experiences and expectations about written communication.

Instant messaging is not a hybrid medium in the way one might classically consider, but the ways in which people brought their own experiences with multiple technologies and communication media to bear on the understanding of the technology made the interpretation of instant messaging a hybrid construction.

From an even larger perspective, the interpretation of technology is hybrid not just because individuals synthesize experiences of multiple affiliational roots when constructing interpretations of technology; the interpretation of technology is also hybrid because people synthesize numerous resources when constructing interpretations—an active, weighted process of interpretive bricolage. Individuals draw from their experiences with related media and technology, their exposure to others' use and understandings of technology, and all the other resources that exist in the socio-technical context in which the technology is being engaged, including pricing plans, advertisements, the news media, and the technology, itself. Individuals synthesize any number of resources in an active engagement with the meaning of technology.

CHAPTER 10

A TECHNOLOGICAL HERMENEUTIC, APPLIED

In this chapter, I touch on a number of ways in which this technological hermeneutic may be applied by the human-computer interaction community. First, I engage each claim of the theory and provide examples of implications on a claim-by-claim basis. These implications are meant to be suggestive, not exhaustive. Then, I more deeply consider the applications of this technological hermeneutic with respect to the following:

- studying the diversity of technological interpretations, and
- suggesting directions for future research.

An understanding of interpretive influences as well as the character of interpretations has significant implications for the field of HCI. The finding that interpretations are hybrid and synthesized constructions suggests, among other things, that direct mappings between complete feature sets and technological interpretations cannot be assumed. I occasionally read studies of technology use in which researchers make assumptions about a default or de facto interpretation of a technology based on its total set of features. This type of assumption is common, for example, in studies of cameraphones. The assumption seems to be that the cameraphone is, by default, a visual communication medium because it has all the necessary features to support visual communication. My research demonstrates that this assumption does not hold; individuals may draw from different related technologies when making sense of a new technology. Sometimes, then, the cameraphone is interpreted as a poor-quality digital camera, an interpretation that does not foreground any of the communicative functionality associated with the camera on the phone. Just because a feature set exists does not mean that all of those features will play into an individual's interpretation of the

technology. Individuals draw from their experiences with related technology in different ways, picking up on different facets of the technology and not necessarily the complete set of features.

The finding that interpretations are dynamic and evolving suggests that studying a technology at different points in its lifecycle could be incredibly productive. The initial release of a technology, when it is most novel, is not the only interesting point in time to study that technology. As new interpretations of technologies are constructed to reflect individuals' recent experiences, changing technical ecologies (e.g., when new technologies are released that remediate existing technologies), or new contexts of use, for example, those older technologies may be ripe for further study and redesign.

The finding that interpretations are influenced by interactions with others' use or understanding of the technology suggests that all technology use is in some way collaborative. Studies of all technologies, then, even personal computing technologies, should explore the larger social system that influences use. This finding also suggests that individuals who may not use the technology, themselves, can also hold important interpretations of the technology, drawing from their exposure to others' use or understanding of the technology. Understanding the interpretations of technology held by non-users—individuals who have rejected the technology as well as individuals who are in other ways impacted by the technology's use—is critical for understanding the full range of interpretations of a technology. The potential for understanding interpretations surrounding non-use of the technology will be, I believe, one of the significant benefits of an analytic focus on technological interpretations.

And finally, the finding that interpretations are influenced by the individual's experiences with related technology suggests that an accounting of affiliated technologies may enable the generation of robust hypotheses about a breadth of uses and understandings for a new technology. Although the current research cannot yet claim predictive power, it does enable highly generative inferences about the potential affiliational roots of a technology.

Understanding the breadth of related technologies that individuals may draw from when constructing interpretations of technology should enable us to predict a breadth of possible interpretations for a new technology. And predicting how new technologies might be interpreted and appropriated is, I believe, one of the grand challenges of human-computer interaction and computer science, more generally.

STUDYING THE DIVERSITY OF TECHNOLOGICAL INTERPRETATIONS

First, and most simply, this articulation of a technological hermeneutic makes explicit the multiple interpretability of technology and argues that the research community must pay heed to and acknowledge the legitimacy of the diversity of technological interpretations. At a very basic level, this articulation of a technological hermeneutic is a call for researchers to interrogate the multiple interpretations of technology.

Interpretations Made Manifest

For technological interpretations to be a useful construct for the HCI community, they have to be methodologically visible or manifested in some analytically approachable way. This research suggests four ways in which interpretations are or can be made manifest: classes of appropriation, conventions of use, meanings of the technology, and beliefs about the technology. The first two manifestations are accessible through observation or analysis of artifacts of everyday technology use. The latter two manifestations may be accessed via semi-structured interviews or open-ended survey questions that allow for individuals to reflect on their use of technology.

Classes of Appropriation

A common approach to understanding the use of a new technology is to undertake inductive analysis of usage data and to resolve examples of use into classes of appropriation: in what ways did individuals or groups of individuals use the technology in question?

In hermeneutics, Ricoeur defines appropriation as the process of making one's own something that was foreign (1976). Gadamer argues that the

process of interpretation culminates with a “fusion of horizons”—the horizon of the reader fusing with the horizon of the text (Gadamer, 2005). Part of this fusion involves appropriating the meaning of the interpretive object into the world of the interpreter (Schneiders, 1999). How someone appropriates technology is a reflection of their interpretation of the technology and how they have fused the meaning of the technology into their own lived experience. Understanding which classes of appropriation apply on an individual basis can help one understand that individual’s interpretation of technology. In the study of cameraphones, individuals appropriated their cameraphones in different ways that signaled the presence of different interpretations within the same family.

One can also extend the traditional classes of appropriation approach by exploring historical and affiliational resonances that are associated with each class of technological appropriation, as demonstrated in the study of photo-enhanced instant messaging. Exploring historical and affiliational resonances enables one to make connections among classes of appropriation and potentially related technologies. Taking an interdisciplinary and historical perspective allows one to see several possible lineages of affiliational roots as well as a wider breadth of technologies possibly drawn from in the interpretation of new technologies. This approach also has the potential to be applied in predictive ways as an understanding of the larger ecology of related technologies may enable researchers to better anticipate the breadth of ways that new technologies may be appropriated.

Conventions of Use

How one understands technology is not only made manifest in what one uses technology for, but also in how one uses technology—the conventions of use. If classes of appropriation relates to the function technology serves, the conventions of use relates to the character of one’s interactions with that technology. Just as classes of appropriation may be analyzed to explore potential affiliational roots, conventions of use may also be analyzed with respect to the potential affiliational resonances they may have. What other

related technologies may individuals draw from in constructing conventions for a new medium?

This manifestation of technological interpretations was applied in the study of instant messaging, with some conventions of instant messaging being similar to the conventions of written communication and other conventions being similar to those of verbal communication. Subsequent interviews confirmed that different individuals hold different expectations about the conventions of instant messaging use that are attributable to both written and verbal communication.

Meanings of the Technology

Interpretations of technology may also be made manifest through the meanings that individuals attribute to the technology. Unlike the previous two manifestations, meaning is only accessible via individual reflection on technology use. The meaning of technology was operationalized in this research as “what the technology allowed the individual to be.” Data about the meaning of technology were collected via two forms of experience sampling—web survey-based experience sampling in the study of instant messaging, when participants would have been sitting at networked computers, and voicemail survey-based experience sampling, when participants were mobile. In both instances, experience sampling was employed so that individuals’ subjective experiences about the meaning of the interaction could be collected as close as possible to the moment of the interaction. The meaning attributed to an interaction with a technology is a reflection of a more symbolic aspect of technological interpretations. Further, understanding the breadth of meanings that individuals ascribe to a technology is yet another clue that multiple interpretations are at play in the use of technology.

Beliefs about the Technology

The final way in which interpretations were made manifest in this research was as explicit articulations of individuals’ beliefs about technology. In the study of BlackBerries, cameraphones, and iPods, individuals were asked to

reflect on their own beliefs about technology specifically as they related to the inferred beliefs of organizations. On its own, one's "beliefs" about a technology is a rather vague catchall for any number of reflections, which, depending on the context or the individual's interpretation of the word "beliefs," may or may not include reflections that convey one's interpretation of technology. Yet one's "beliefs" about technology is, in general, a large enough construct to engage one's subjective understanding of technology, and that is, in the end, one's interpretation.

Challenges in Studying Technological Interpretations

Two of the manifestations discussed above—classes of appropriation and conventions of use—are indirect representations of interpretations. Artifacts from the use of technology can be analyzed in highly generative ways to posit a breadth of possible interpretations and related technologies. These analytic techniques may be valuable for designers, particularly in early stages of design, but the insights they produce are only inferences about what individuals' interpretations might be. One can, of course, validate or invalidate inferences about a particular individual's interpretations through interviews, as was done in the study of cameraphones.

Meanings of the technology and beliefs about the technology, on the other hand, reflect individuals' actual interpretations of technology. However, the language of "meanings" and "beliefs" can be vague and arbitrary if not grounded in a very specific context. A constraining temporal context was applied in the studies of instant messaging and cameraphones using experience sampling. A different type of constraining context was applied in the study of BlackBerries, cameraphones, and iPods; individuals' beliefs were elicited with regard to a specific interpretive resource (e.g., pricing plans or news stories). Generalizing an individual's interpretation beyond one specific context is a challenge, however, particularly when asking individuals to reflect on something like interpretation that is not part of the common linguistic repertoire.

In general, the challenge of studying the diversity of interpretations, then, is in bridging between the individual's reflective articulation of aspects of their

interpretation, highly constrained and grounded in a specific interaction or context, and the more generative inferences about interpretation drawn from artifacts of use.

SUGGESTING DIRECTIONS FOR FUTURE RESEARCH

Numerous directions for future work present themselves based on this research. Some areas for future research fall out of and build on this empirically grounded articulation of a technological hermeneutic, including the following:

- Future studies of the diversity of technological interpretations should explore a richer linguistic repertoire, beyond “beliefs” and “meanings,” for reflecting about interpretations with study participants. What language best captures the way individuals are able to talk about their interpretations of technology? What are the most productive and accessible ways to frame interview or survey questions about an individual’s interpretation of technology?
- Future studies of technological interpretations should explore a broader set of technologies, beyond computer-mediated messaging systems. How do people interpret emergent forms of consumer robotics, for example? What are the similarities and differences in the interpretive process or the nature of interpretation for different classes of technologies?
- Schleiermacher’s articulation of the hermeneutic circle (Jasper, 2004) and Ricoeur’s methodological criteria for a domain to be hermeneutic (1981) consider the layered-ness of an artifact to be critical to the interpretive process. Technology is multi-layered, from specific user interface components to features to devices and from applications to infrastructure. The empirical basis of this research identified a relationship between the interpretation of devices and the interpretation of data or content on those devices. Existing research in human-computer interaction has found that individuals’ understanding of features and applications is related to individuals’ understanding of the infrastructure underlying those features and applications (e.g., Vaida, Grinter, Ducheneaut, Edwards & Newman,

2005; Volda, Volda, Edwards & Grinter, 2007). Future research in this area should further explore the relationships among the interpretation of various layers of technology. In what ways does the interpretation at one technical layer influence the interpretation at other technical layers?

- The empirical basis of this research suggests that the interpretive process reflects an active, weighted synthesis of resources. Future research should explore how individuals weigh different classes of resources in the process of interpretive bricolage. What are the most important resources and under what conditions?
- The empirical basis of this research did not find any explicit distinction between processes of the interpretation of technologies that were either new to the marketplace or new to the individual and the ongoing reinterpretation of one's existing technologies. Only one of the five studies, however, explored the interpretation of a "new" technology. Future research in this area should compare the nature of interpretation of technologies that are (a) new and very novel to the marketplace, such that the most minimal of interpretive resources would exist (e.g., studying the interpretation of the Segway when it was first sold), (b) new to the individual but not novel to the marketplace, such that interpretive resources would be commonplace but interpretation would still require a high degree of personal appropriation (e.g., studying the interpretation of the cellphone by individuals just now adopting the technology) and (c) previously adopted and used on a continual basis, such that the interpretive process would be ongoing (e.g., studying the reinterpretation of the iPod by current iPod owners).

Other areas for future research fall out of the continued application of hermeneutics to human-computer interaction as an extension of the current line of inquiry. These research directions include the following:

- Hermeneutic theory suggests that interpretations are related to both the context of the interpreter and the context of the interpreted artifact (Gadamer, 2005). The domain of hermeneutics generally considers context on a larger scale than does human-computer interaction, but this

theory raises interesting questions about the ways that technological interpretations might be contingent upon the individual's more micro-level context. Future research in this area should explore the interpretation of technology across contexts, for example, the interpretation of a BlackBerry across both domestic and work-related contexts. If the meaning of technology were to vary with context, this finding would suggest significant design implications for technology in the domain of mobile and ubiquitous computing.

- A relatively recent branch of hermeneutics, liberation hermeneutics, has argued that the research community must pay more attention to individuals who are impacted (and frequently oppressed) by others' interpretive activities (Gutierrez, 1988). Educational and theological offshoots of liberation hermeneutics have sought to identify ways to empower individuals and groups of individuals who may have previously been oppressed as a result of the interpretive activities of dominant groups. Future research in this area should interrogate technological interpretations for their potential impact on other stakeholders. What are methods that might be employed to track the impact of technological interpretations on other users or non-users of the technology? What are methods that might be employed to check or challenge interpretations of technology that pose a threat to individuals or groups of individuals? In what ways can non-dominant users or non-users of technology be empowered to contribute to the interpretive discourse?

The myriad directions for future work suggest that this articulation of a technological hermeneutic is the kernel of a much larger research agenda, one that values and validates the subjective individual experience in pursuit of a more generalizable understanding of how people come to understand the meaning of technology in the context of their everyday lives.

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