Chatting with Teenagers: Considering the Place of Chat Technologies in Teen Life

REBECCA E. GRINTER
Georgia Institute of Technology
LEYSIA PALEN
University of Aarhus
and
MARGERY ELDRIDGE
Image Semantics Ltd.

In the last few years, teenagers have been on the forefront of adopting short message service (SMS), a mobile phone-based text messaging system, and instant messaging (IM), a computer-based text chat system. However, while teenage adoption of SMS had led to a series of studies examining the reasons for its popularity, IM use in the teenage population remains understudied. This omission becomes significant given the increasing interest in domestic computing among human-computer interaction (HCI) and computer-supported cooperative work (CSCW) researchers. Further, because of the dearth of empirical work on teenage use of IM, we find that IM and SMS are sometimes incorrectly assumed to share the same features of use. To address these concerns, we revisit our own studies of SMS and IM use and reexamine them in tandem with other published studies on teenage chat. We consider similarities and differences in styles of SMS and IM use and how chat technologies enable the pursuit of teenage independence. We examine how differences are born out of technological differences and financial cost structures. We discuss how SMS and IM are used in concert to provide increased awareness and to coordinate inter-household communications, and how privacy is regulated within the individual household as a means of maintaining these communications.

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1. INTRODUCTION

At about the same time—the late 1990's—teenagers rapidly adopted two text-based technologies: short message service (SMS) and instant messaging (IM). Media reports of teens' intense usage highlighted some of the more exotic practices of both technologies, while simultaneously creating concern about how much time teenagers seemed to devote to them. In the case of SMS, media reports, as well as the widespread visibility of use, spawned a series of studies of teenagers' SMS practices [Grinter and Eldridge 2001, 2003; Ito 2001; Ito et al. 2005; Ling 2000, 2004; Ling and Yttri 2002; Taylor and Harper 2002, 2003].

In contrast, despite similar media attention devoted to IM use, there have been far fewer empirical studies examining the details of teenage use its [Grinter and Palen 2002; Lenhart et al. 2001; Schiano et al. 2002]. This omission was made even more surprising by the rapid rate of innovation in instant messaging, both in research and commercial systems, including mobile clients and picture-based messaging (see, e.g., Tang et al. [2001]). Although instant messaging has evolved technologically, and the media reminds us of the popularity of the system among teenagers, little is known about usage practices. Instead, much research about IM practices has focused on use in the workplace by adults [Herbsleb et al. 2002; Isaacs et al. 2002], though there has been attention paid to use by college students, including mid-90's work on a pre-IM chat system [Ackerman and Palen 1996], as well as more recent IM use in university settings [Baron et al. 2003; Voida and Mynatt 2005; Voida et al. 2002].

This peculiar lack of IM studies also seems surprising given the relative interest in domestic computing. As computers migrate out of the workplace into homes, researchers have become more focused on studying domestic technology usage [Grinter et al. 2005; Jackson et al. 2004; Kraut et al. 1999; Livingstone 2002; Turow and Kavanaugh 2003; Wellman and Haythornthwaite 2002]. This is further fueled by visions of potentially "smart homes" that suggest an ever-increasing penetration of computing technology into everyday life (see, e.g., Edwards and Grinter [2001] and Rodden and Benford [2003]). So, studies of IM, and particularly its use by teenagers, would not only probably be able to contribute to an understanding of teenagers' electronic lives, but could also be another window into the complex world of domestic technology usage.

Furthermore, we have found that in conversation about chat, IM and SMS tend to get grouped together. We have found that we are asked to comment on these technologies as though they are the uniformly similar, even though they have distinct use features. This article reexamines our two previous qualitative studies of SMS and IM use, and situates and supplements them with findings from the larger set of studies that the area now affords. We consider these technologies together, and discuss where there are key differences, as well as similarities. The collective data on IM remains relatively small, but can be used as a counterpoint to highlight some useful differences that are worth considering as technologies for the home continue forward. Our objective is to describe the nature of the use, factors, and consequences of chat technologies in teen life.

The article is organized as follows. First, we review the findings that have emerged from studies of teenage SMS usage. Next, we describe SMS and IM

technologies, and the participants in two empirical studies of SMS and IM use. We use findings from the literature and the SMS study to compare types and styles of SMS and IM use, the relationship between potential and actual contacts, the independence provided by both technologies, the expectation of availability, and financial costs. The discussion builds on these findings to examine how technical differences between IM and SMS, in particular the visibility of the infrastructure, influence usage; the mechanisms teenagers use to establish privacy in their highly available world; and the use of SMS and IM in concert to provide awareness and coordinate communications.

2. OVERVIEW OF SMS AND IM

Short message service (SMS) is a mobile phone-based text messaging system available on global system mobile (GSM) networks. Although originally deployed with GSM networks in 1992, SMS did not take off with teenagers until a certain type of calling plan made mobile phones affordable to teenagers. Calling plans that allowed an individual (typically, a parent or guardian) to pay for the phone up front, and then to buy minutes of airtime in the form of vouchers, encouraged teenagers to purchase and use mobile phones.

At the time of the study reported here, SMS messages were restricted to 160 characters of ASCII text. These messages could be sent from any mobile phone to any other, regardless of an individual's wireless service provider. Although not real-time, most text messages get delivered in approximately five minutes.

Instant messaging (IM) is primarily a computer-based text messaging system. One of the first systems—ICQ—was deployed in 1996. IM was "discovered" by teenagers as computers migrated away from the office and into the home. By 2001, the Pew Internet Foundation [Lenhart et al. 2001] estimated that approximately 13 million teens used IM.

At the time of the study reported here, IM systems consisted of two main parts: a buddy list and chat mechanism. The buddy list window displayed the availability of buddies on the list (as determined by their typing at a computer). IM systems provided multiple types of chatting facility, all of which were real-time, but varied as to whether they supported point-to-point conversation among two people, group chat, or a dedicated chat "room" where individuals could log on and join preexisting conversations. With the exception of a few clients that spanned multiple systems, such as Jabber, all IM clients only supported IM chat among users employing the same technology (e.g., AIM, MSN, Yahoo!). One final feature of IM that played an important role among the teens interviewed was blocking controls. Blocking controls allow an individual to decide whether they want to receive IM messages from specific individuals, or classes of users such as those people who are not on the buddy list (and presumably not known).

3. DOMESTIC IT COMMUNICATIONS

Ever since the widespread adoption of the home landline telephone, people have had questions and concerns about the impact of communication technologies on the lives of their users. In the early 1900's, telephone executives worried about

the amount of phone calls that consisted of idle gossip, and sought to discourage these practices [Fischer 1992]. This general concern later turned to focus on teenagers in particular. For example, in 1929, in their study of Middletown, the Lynds reported that the telephone and the depersonalized communications it offered were in part responsible for the increased sexual liberation of teenagers [Lynd and Lynd 1929].

A century later, the telephone still dominates home communications [Anderson et al. 1999]. Yet, the last decade has seen two new communication technologies enter the home: the Internet-connected computer and mobile phone. Initially, computers arrived at home as the result of increased interest in telecommuting. Consequently, the first uses of home computers were for remote workplace activities, including communication [Vitalari et al. 1986].[1] However, as households became increasingly aware of and interested in Internet technologies, so did Internet-based communication with friends and family become a source of recreational computing.

The increased use of computers at home has been the source of research studies. In particular, use of the two Internet-based technologies electronic mail (email) and the world wide web (WWW) has been reported on (see, e.g., Livingstone [2002], Turow and Kavanaugh [2003], and [Wellman and Haythornthwaite [2002]). In their study of communications-based (such as email) versus information-based (such as WWW) computing activities, Kraut et al. [1999] found that households tended to prefer communication activities over information activities. The authors hypothesize that the lure of communication activities may be their open-ended nature in that one message invites another. However, in their research about computer use at home, Jackson et al. [2004] found that the use of email and so forth for communication still depends on collective computer access vis-à-vis economic status. In other words, our ability to use the computer as a communication appliance requires not only personal access; it also requires that members of our social circle have this, as well.

It is into this economically stratified environment that instant messaging (IM) arrived, finding a place in more affluent households where computers could be used as communication devices. Some of the earliest studies of IM usage focused on its uptake in workplace settings [Nardi et al. 2000]. However, IM also found a use at home among teenagers eager to communicate with their friends outside school hours [Grinter and Palen 2002; Lenhart et al. 2001; Schiano et al. 2002].

At the same time that IM was taking off, Europe and Asia saw an explosion in the adoption and use of another communication medium: the mobile phone. Again, reports identified teenagers as lead adopters and heavy users of this technology, once it became affordable to them. This trend fits with previous studies about the relative adoption rates of new media among teenagers. For example, Livingstone [2002] found that households with children lead media diffusion, or in other words, are early adopters.

Although traditionally a voice-based communications technology, one mobile telephone standard, known as global system mobile (GSM) and used in

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[1]This use of computers might have pleased those early telephony executives.

Europe and parts of Asia, also supported a text-based communication system, called short message service (SMS). This service was especially appealing to teenagers, who adopted it rapidly. The earliest reports of teenage use of text messages, as SMS is colloquially known in some parts of the world, came from Scandinavian countries, where mobile phone adoption among teens was especially early. Indeed, the teenage shift from voice to text was so fast that studies initially emphasizing voice usage patterns underwent a rapid methodological change [Rautiainen and Kasesniemi 2000].

In contrast to the small number of studies performed on teenage IM usage, a number of researchers located in a variety of countries have explored the use of SMS among teenagers. Some early studies took advantage of large-trend datasets and bore out the dramatic nature of the shift from voice to text in teenagers' mobile usage patterns [Ling 2000]. Subsequent studies have provided details about what teenagers send text messages about, and also highlighted a number of common themes about SMS usage.

First, the SMS literature describes what types of activities teenagers coordinate via SMS. A common theme in these descriptions is an emphasis on the "softening" of time or schedules that emerged through the use of text messages to microcoordinate [Ling 2004]. A seminal study by Ling and Yttri [2002] defines microcoordination as the instrumental use of mobile phones to coordinate in real-time by allowing an agreement to be adjusted as needed. So, for example, rather than setting a time to meet face-to-face, teenagers use SMS to converge in real-time on a common location.

Second, a number of studies have identified with whom teenagers communicate. Studies report that teenagers typically interact with their peers via SMS; family and strangers do not tend to be the primary target for SMS communications [Grinter and Eldridge 2001; Ling 2004; Taylor and Harper 2002].

Third, the use of SMS to establish a sense of independence among teens emerges in studies [Ito 2001; Kasesniemi and Rautiainen 2002]. SMS messages allow teenagers to work within the constraints imposed upon them, such as their inability to drive and consequent reliance on public or parental transportation, and scheduling challenges that arise from their need to balance both school- and parent-set requirements against their own desires for sociability. SMS provides some independence by being a resource that teenagers can use to communicate with each other, despite these constraints.

Fourth, studies show how SMS and the continuous presence of a mobile phone make teenagers more available to each other [Ling 2004]. However, increased availability also brings certain responsibilities. Studies have reported that responding to messages in a timely manner has become an expectation of good SMS practice among teenagers [Grinter and Eldridge 2001; Taylor and Harper 2003].

Fifth, and finally, financial considerations emerge as a factor in the initial adoption and continued use of SMS among teenagers [Grinter and Eldridge 2001; Ling 2004]. Pay-as-you-go plans that made phones inexpensive enough to be owned by teenagers reduced the initial start-up costs for mobile adoption. SMS messages, with their fixed rate billing, offered teenagers an

attractive "costs known up front" alternative to the ambiguity of pricing in a voice call.

In this article, we build on these previous reports by examining the uses of SMS and IM. Drawing from two studies, as well as findings from the literature, we consider the two media as used by teenagers. After describing the systems and studies, we turn to a discussion of the similarities and differences between the types and styles of SMS and IM use, how contacts are made, the affordances for personal independence, expectations of availability, and the usage costs. The discussion then builds on these findings to examine how technical differences between the two systems influence use and the mechanisms teenagers use to establish privacy. We also consider how SMS and IM are used in concert to provide increased awareness and coordinate their conversations.

4. METHODS

The data in this article is drawn from two studies that have been described elsewhere [Grinter and Eldridge 2001, 2003; Grinter and Palen 2002] and collectively reanalyzed here. The first study focused on SMS usage among teenagers in the United Kingdom. The second study focused on IM usage among teenagers in both the United States and the United Kingdom. In this section we provide an overview of the technologies, participants, and studies.

4.1 IM Study

The IM study took place during 2000–2001. At this time, IM software was typically used on computers connected to the Internet; mobile clients were available, but not commonly used. During the study, we only heard of one instance of a person experimenting with a wireless phone-based version of an IM system. We studied 13 teenagers living at home, five girls and eight boys, aged between 14–17 (in the initial IM study, we also included three teenagers who were at the University, and for this particular analysis we removed their data to make the IM data more age-aligned with the SMS data).

The participants in the IM study came from both the United States (ten) and United Kingdom (three). The teenagers shared some important demographic features. First, they lived in regions known for their high-tech and research employment. In the United Kingdom, the teenagers lived around Cambridge, colloquially known as Silicon Fen. In the United States, the teenagers lived in Silicon Valley, home to numerous high-tech employers, as well as Stanford and UC Berkeley. All of the participants had parents who worked in the high-tech industry or held appointments at the University. Second, these regions share another related demographic similarity in that the average household income in both communities is higher than the national average. The ownership and acceptance of home computers/mobile phones may have been more widespread due to these demographics.

The IM study consisted of one-on-one interviews that lasted for about one hour each. The interview was supplemented by the presence of a laptop computer that had a number of IM clients installed. During the interview,

teenagers were encouraged to demonstrate the concepts they were explaining by using the IM systems installed on the machine.

Our study was primarily focused on the exchange of messages, content, and physical and social use contexts in the home.

4.2 SMS Study

The SMS study took place in 2000. At this time, despite charges for sending (but not receiving) of approximately GB£0.10 per SMS message (€0.16 or US$0.14), residents of the United Kingdom sent 560 million text messages a month. Five girls and five boys aged between 15–16 years old participated in the study.

These teenagers all came from Cambridge, in the United Kingdom. In addition to owning mobile phones, all of the participants had broadband access to the Internet in their homes. For this study, we administered a prestudy questionnaire designed to elicit background information. Second, we asked the teenagers to log all their incoming and outgoing SMS messages for seven consecutive days. Third, the teenagers participated in one of two group interviews of five teenagers each.

4.3 Revisiting the Data

In this article, we revisit and reconsider the qualitative data collected from both studies. At the time of these original studies, chat technologies for widespread teen use were on the rise, yet each of these technologies felt distinctly different at the time. For that reason and other constraints of experimental design, the studies were conducted somewhat differently. Here, we describe the data we have available to use, and explain how we will treat this corpus. The instant messaging study relied on interview methods. In the short messaging service study, the bulk of qualitative data was also generated through interviews, but additional descriptive information came from the SMS logs that elaborated the interviews. Our analysis relies on a reexamination of the interview data, as these resulted in themes that we could consider together in both the SMS and IM cases.

This analysis began with an extensive review of the SMS literature. As we argued earlier, while IM use among teens has not been the focus of much research, SMS and now, multimedia messaging service (MMS) use among teenagers has been extensively studied. We took the body of knowledge that exists about SMS/MMS and searched this for common themes. To do this, we identified the results reported in each article, and then we began to compare across the literature. Over time, five themes emerged as being routinely present in the SMS literature, which are: the types of activity teenagers coordinate, who they communicate with, the use of the technology to establish independence, the effects of continuous availability on teenagers, and the role of finances. Having arrived at these five broad themes, the final stage of the literature analysis filled in each category with details from the research reports.

The second broad phase of the analysis was to fit our own SMS data into our literature-based thematic categorization. This "fitting" of SMS was necessary to

see whether the thematic categories we had developed had enough substance that so we could take and apply them to our own detailed data. It also provided the valuable empirical experience of working with the categories and supported further category refinement. Specifically, the SMS data occasionally raised questions about details of the category, which we answered by rereading the literature.

Third, and finally, we began to analyze the IM data in terms of the thematic categories. At this point, it was essential that the categories contain both reported findings and our own SMS data. Specifically, having the richness of a dataset in particular allowed us to compare like types; two collections of interview-based data. In the next section, we describe the results of these reanalyses, which helped highlight differences and similarities.

Since the datasets come from two different countries, we feel it is necessary to address the matter of cultural difference in this kind of collective analysis. In general, the collectively published findings on SMS and IM use neither address cultural differences nor strongly identify cultural features. This remains an important task for our research community. However, to date the published findings themselves do not permit a cross-cultural analysis; the basic features of use are described as similar for teenagers across the countries of study, which include Germany, Finland, Norway, and Japan. When we consider our own data in this mix, which comes from both the US and the UK, we are reluctant to make claims about broad cultural differences for these same reasons. Since the collective analysis here rests on a global perspective, we feel that while certainly there are features of use that likely vary by language and culture, the patterns of behavior we see tend to be generally descriptive of the early, widespread adoption of chat technologies by the populations of teens that are able to seek access to them. However, where we see differences based on country of study, we point them out.

5. CONSIDERING IM AND SMS: DIFFERENCES AND SIMILARITIES

The short message service literature describing teenage use reports on five themes: the nature of what is coordinated and how, who teens exchange messages with, establishing independence, increased communicative availability, and the role of financial considerations. In this section, we take up each of these themes, and consider the findings from SMS studies, including our own, while using our IM study as counterpoint to illuminate similarities and differences in both use and practice.

5.1 Coordination: How are SMS and IM Used?

Studies of SMS have described how teenagers have their phones turned on and kept close at all times. The participants in our SMS study followed this behavior; indeed, many of them not only kept their phones on during the interviews, but several responded to incoming text messages while we were talking to them! Further, during the interviews, several of the teenagers said that they never turned off their phones, only turned the volume down and put them on to charge when they turned off their lights and went to sleep.

In contrast, teens described two modes of IM usage: continuous-sporadic and discrete-intensive. The continuous-sporadic mode involved running IM software for extended periods of time (days, weeks, or perhaps only logging off when the computer was rebooted). Chat windows might be minimized, but never closed, and text was added into the window over the course of hours and days. All the teenagers who used IM in this way had their own computer and access to an always-on Internet connection. However, owning their own computers and having access to an always-on connection did not always lead to continuous-sporadic IM usage. Other teenagers preferred to IM in discrete-intensive sessions. The discrete-intensive mode was characterized by making a time for IM (either because it was time to IM or because—in the case of shared computers and family phonelines—the teenager had managed to acquire temporary control over all the resources required to IM). Once logged on, the teenagers described either an exclusive focus on IM, or juggling IM with other activities such as web browsing (for school projects and recreation) and answering their email. Among our participants, there were four continuous-sporadic and nine discrete-intensive IM users.

Although both uses of IM could be appropriated for microcoordination, neither style seemed to encourage the practice in the same way that SMS did. This is illustrated through a close comparison of two of the broad uses that teenagers described as having for SMS and IM. Broadly speaking, teenagers described using both SMS and IM to plan events and to discuss homework. However, the details of these descriptions reveal differences between the media.

Reports of SMS use have identified hypercoordination [Ling and Yttri 2002] as a distinct usage genre, one that involves using the phone to revise and update existing plans. In our SMS study, we saw numerous examples of this in the logs; message descriptions that were "I'm running late, I'll see you outside the cinema," "the bus is late, I'll be about 15 minutes late," and so forth. Examples like these point to the existence of a previous plan (a plan to be at the cinema, a plan delayed by 15 minutes due to the bus).

In contrast, event planning discussions involving IM frequently referred to something that we ended up characterizing as the "phone circle." Phone circles arise during the initial planning phase the time when the location, transportation to the destination, and coordinating times that the teenagers can actually meet (managing their curfews, as well as the schedules of other householders) are being negotiated among the teens. The phone circle arose during these times because the telephone only supports point-to-point voice calls (at most, three-way), so for group outings, the teens found themselves calling multiple parties, and then recalling the original parties as new information and constraints materialized. IM removed these many rounds of calling, since all participants could be involved in a single group chat session.

In addition to avoiding phone circles, some teens described valuing the integration of IM with other electronic resources in initial planning. We heard of several examples. URLs were often embedded into messages to coordinate the viewing of a particular website (such as a specific trailer for a movie, film times and places, and clothes shops having sales). In other cases, teenagers described

inserting pictures into an IM conversation, such as pictures of specific clothes that would be fun to try on during a shopping trip.

We saw similar patterns of difference when comparing SMS and IM data about homework help. In the case of SMS, we saw messages in our own study that appeared to be quick requests about specific problems ("do u no the answer 2 Q5?"). IM could be used for this type of exchange, but it also supported broader topic discussions. In several of the interviews, we heard about IM being used as a means to support French language learning and history review groups. The French language group met online to practice their written French via a French only IM chat session. The history review group used IM to discuss various book chapters.

Broadly speaking, IM and SMS both provide support for the same types of needs: event planning and homework discussions. However, careful consideration of the uses of these two media suggests slightly different purposes. SMS, the cursory medium, seemed to be used to interject short messages into ongoing discussions, to microcoordinate, or to ask a question where the context is already known (e.g., what Q5 is). In comparison, IM was well-suited to establishing a plan, and trying to engage lesson material more copiously in a longer discussion. IM, unlike SMS, seems to provide more opportunities to establish the context that makes the short communications of SMS function effectively.

The mobility of SMS, in contrast to the tethered nature of IM use, makes a significant difference in how these technologies are used for coordination. Being mobile was a precursor to many of the situations in which microcoordination became a meaningful activity: If people are about to arrive at a location to meet a friend, but are running a few minutes late, SMS allows people the opportunity to rectify the situation. IM's existence on a networked computer means that it cannot as easily assist in this regard. However, for teens, IM excels in the coordination of the potentially complicated planning phase of events because it allows multiple people to chat simultaneously, rather than iterate multiple times over multiple people as times and places to meet get further and further refined. Furthermore, because most teens access IM from home, talking to mom or dad in between messages to make sure, for example, that they could get a ride on Saturday night at 8pm, provided a great convenience. Of course, since the time of these studies, IM has migrated onto phone clients, and this contrast raises questions, specifically: Do teenagers find the same use for IM on a mobile phone as they have for SMS? As of yet, this question remains empirically unanswered.

5.2 Who: Potential versus Actual Contacts

Previous studies of SMS use have shown that while teens' SMS address books typically contain many numbers, they make contact with a much smaller percentage of people [Ito 2001; Smith et al. 2003]. One reason for this difference between potential and actual contacts is the use of the address book as an indication of popularity [Berg et al. 2003; Taylor and Harper 2003]. Researchers found that when a teen's mobile is left on a table, another teenager might very well pick it up to inspect the contact list. In our own study of SMS, we saw a

similar attachment to the significance of the address book: All the teenagers reported having full address books. Adding a new contact usually meant deleting an old contact. During interviews, they described how the deletion process was typically a sign that the friendship was either never very strong or had lapsed over time. Contacts and their transformation over time was a gauge of popularity and a decline in fortune. So, the reasons why teenagers inspected others' books are twofold: to assess the owner's degree of popularity, and then to assess their own (do they make the address book cut or not?).

In an early report of IM usage among teenagers, Schiano et al. [2002] reported similarly long lists of potential contacts. Our IM study also found the same pattern that teenagers' IM potential contacts far exceeded their actual contacts. We were able to gather this information by having the interviewee log onto his or her preferred IM client, which would then produce the buddy list. Once available, the buddy list was available to us as a prop to shape the interview questions. All the study participants had buddy lists that contained over 50 contacts, often organized into various groups such as school, summer camp, old school, and so forth.

Our assumption would be that buddy lists would be much less subject to scrutiny than mobile phone address books. This proved to be the case partially, but not exclusively. Occasions to examine each other's buddy lists were limited by the presence and use of IM on a computer. Despite these differences, most of the teenagers reported that family and friends still inspected their buddy lists. For example, we heard about curious siblings inspecting buddy lists. More commonly, the teenagers recounted experiences of having friends over to their house and then collectively IMing remote people. During this collaborative session, the friend (or friends) would be able to view the teenager's buddy list. So, despite being used in the potentially more private space of the home, buddy lists, like their SMS equivalent, seemed to be a mechanism for teenagers to project their social identities as people who had lots of potential, if not actual, contacts.

While examination of the interview data about the differences between actual and potential contacts revealed similar reasons to maintain large address books and buddy lists, we did identify a cultural difference. This difference manifested itself entirely within the IM study and was first called to our attention by the categorization schemes used in the buddy lists. Unlike SMS contact lists, which are listed by name of the person, IM buddies could be organized into groups. The teenagers varied in just how many groups they had, but all the teenagers had some groups, and it was the names that suggested some differences.

The groups that the American teenagers created struck us, in particular. First, a number of them had groups referring to summer camp experiences such as "Space Camp." These camp groups were notably absent from any of the British teenagers' organizational schemes. This difference may be present due to the typically longer summer holiday, as well as the tradition of teenagers participating in some type of summer learning opportunity.

Second, it was noticeable that several of the American teenagers had buddy groupings that referred to previous schools, sometimes far from their current residence. It struck us as being an indicator of the higher degree of mobility

that has often been said to characterize life in the United States. Many of the teenagers in the study had already moved some considerable distance in their lifetime, switching schools, and many switching states and time zones. IM was a means to keep in touch with these old friends.

In summary, while we saw a rather consistent use of the address book/buddy list between SMS and IM, differences emerged the ways that British and American teens organized their buddies into groups based on their experiences. The use of address books as a means to demonstrate popularity has been taken up in the design of new interfaces to the address book so as to support making these decisions more explicit [Berg et al. 2003]. However, this analysis suggests that similar exploration for IM buddy lists might be equally as appealing to teenagers who eager to show how popular they are. This may also transfer readily to the mobile IM context, which would bring the buddy lists out from behind the computer and into apparently more viewable locations which are subject to scrutiny, just as the SMS contact book is.

5.3 Independence: Liberation and Control

Chat technologies provide a means for liberation, and teens report a variety of means for maintaining these liberties. Most studies of SMS use have commented on how the technology helps teens work around the constraints imposed on them by their status as teenagers. This finding was mirrored in our IM data, where teenagers described limits on their freedom because of family obligations and expectations, their pre-driving age, school schedules, and other demands that they nevertheless strove to overcome. However, when we began to explore the SMS and IM data in more detail, another theme around independence emerged: that of control of awareness. It was not just the ability to use the systems to work around constraints that characterized independence, but also the ability to control who *knew* about the various constraints being worked around. In both studies, three sources of control emerged (often used in conjunction): sound, space, and blending into other activities. It was in the examination of these three sources of control that some differences between SMS and IM emerged.

First, the ability to silence the technology allowed interactions to go unnoticed. Muting the device meant that inbound messages did not come to the attention of anyone in auditory range. Keyboarding quietly was also a skill that came up in discussion in both studies. The ability to type softly on either the computer or phone pad also went some way towards making outbound messages invisible to others.

Second, the teenagers described spaces, typically in the home, that provided a good deal of invisibility. For both SMS and IM, private bedrooms provided a good deal of cover for messaging. One of the SMSing teens described texting late at night under the bed covers so that the light of the phone could not be seen under the door by her parents. Another teen described receiving a message late at night from his sister who had stayed out beyond her curfew. She was downstairs outside the front door, unable to get in; he was upstairs in his bedroom SMSing past his sleeping curfew. He went down and let her in

and the event passed apparently unnoticed by their parents (no punishments, despite the fact that both were beyond their curfews).

Like SMS, those people lucky enough to have a computer in their bedroom and either a phone line (with a muted modem) or a broadband connection reported a similar degree of freedom in being able to IM outside of parent-sanctioned times. To avoid detection around bedtime, one teenager explained how he left his computer running (with an away message that explained his temporary lack of response) and switched off the monitor, got into bed, said goodnight to his visiting parents, and then once safely out of earshot, resumed his conversations. In another IM case, a conversation took place in the early hours of the morning in California. The other participant in the exchange was a friend who was temporarily living in France, so this was a convenient time for both parties to IM, but not one that the Californian teens' parents would approve of, given the late hour on a school night.

One use of space that did not appear in studies of IM was the use of one's body in the space to carve out a private area in which an activity could be hidden. We saw just one example of this type of use in the SMS log data. This was a message where, included in the description of why she was late calling the recipient (because her father had just opened the phone bill and, not pleased at the number of household calls, was now shouting at her about her usage), there was also an explanation of how the message was accomplished (by standing with her back to her father so she could type on the phone unnoticed). Another example of this type of reconfiguration of space was described by SMS teens when they wanted to text message during class. Specifically, we received demonstrations during our interviews from several teenagers keen to show us how they could place the mobile phone under their desks, and type while looking at us, at least for a time.

Using IM on a shared computer always implied being in a shared space. The teenagers in this situation described the third way of hiding their IM conversations. In particular, several teenagers explained that their IM use blended into their computer work. From a distance (and when the screen is not visible), IM typing looks very much like other computer-based work. If a parent or sibling moved closer, the IM use was rendered temporarily invisible through window management that consisted of minimizing or hiding chat windows.

Comparison of SMS and IM shows that they are both employed to achieve independence, not just in working around constraints, but in managing who knows what is going on. Our data also supports other observations about home life and how householders engage in not just public activities, but also in those which they attempt to hide from each other for a variety of reasons [Bell et al. 2005]. Teenagers have found ways to make both SMS and IM technologies have the necessary degree of private and public usage and control through sound, space usage (including their own physical presence), and their ability to come of age the technology with routines.

IM users are also able to use the third control mechanism of blending their IM use into a more general notion of computer-based work. IM, unlike SMS, seems to have found a means to disappear by blending into routines [Tolmie et al. 2002]. Instead of relying exclusively on perceptual disappearance through

sound and space—the most emphasized version of ubiquitous computing—
teens used the establishment of routines around the computer to make their
conversations invisible from other members of the household. This also sug-
gests further work to explore whether and why the mobile phone seems not to
disappear in use.

5.4 Availability: Being Online versus Being in Conversation

Studies of SMS use have shown that teenagers have strong expectations of each
other's availability [Ling 2004]. A reported good SMS user norm is someone who
replies to his or her messages in a timely manner [Taylor and Harper 2002].
Our SMS study revealed exactly the same patterns of typical timely response,
and an expectation to be available to and correspond with people. Teenagers
discussed their desire to receive timely responses from friends, and also talked
about being responsive to their peers.

Unlike SMS technology, IM supports availability explicitly through the pres-
ence function. In studies of adult IM use, researchers have shown that system-
based "presence" information does not predict actual availability [Isaacs et al.
2002]. In our study of IM use among teens, their responses to and manage-
ment of awareness was much more similar to SMS teens than to IM adults.
However, the details of how they managed this depended on their usage style:
discrete-intensive or continuous-sporadic.

When discrete-intensive IM users connected, it was a sign to their buddies
that they were making themselves available for IM. These teenagers described
the experience of logging on as making time to chat with their online friends,
and they talked about looking forward to having as many conversations as they
could before they had to log off.

The assumption that discrete-intensive users were available for conversa-
tion when they were available online was reinforced through another practice
they described in the interviews: that of pouncing, or waylaying, as it is also
known [Bradner et al. 1999]. Pouncing occurs when someone "lies in wait" and
immediately pounces another who comes online by IMing them. The discrete-
intensive users were all familiar with pouncing, not just as recipients, but also
as instigators, immediately jumping on friends who appeared online. Again,
the desire to maximize limited conversational time drove these practices, and
online availability was equated to conversational availability.

In contrast, continuous-sporadic users did not nearly describe these levels
of intensity in conversational engagement. The few teenagers who used IM
this way turned to another feature of IM, the away message, to explain their
conversational absences,[2] in particular, they made use of away messages to
"fill in" their absences by explaining more about where they were during their
lapses. For example, they described leaving messages saying that they had
gone to eat or take a bath. In summary then, the away message was used to
extend their presence through a richer contextual awareness. The fact that
continuous-sporadic users felt compelled to do so suggests that they also recog-
nize other teens' expectations that they are available, but since they spend time

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[2]A pattern also described by Baron et al. [2003] in their study of college students' use of IM.

online and yet disconnected from conversation, they have to provide a reason why.

In addition to explaining long absences, continuous-sporadic users also described using the away message to cover short-term absences. In these cases, several teenagers described away messages that would both explain their departures and take another closing turn in the ongoing conversation. For example, one teenager described a message she left for a friend that explained that her parents wanted to talk with her, and that she agreed with her current conversational partner, and would like to discuss this in more detail in person at school tomorrow.

Understanding the away message in the context of being available raises interesting questions for SMS research. In our SMS data, we saw some messages that might have a similar function to away messages, filling in some context as to why conversation was not in progress. In the previous section, we described the case of one teenager who was explaining why she wasn't able to converse with her boyfriend due to her father's fury with the current phone bill. This could be read as an away message for the landline telephone conversation, delivered by SMS. Other messages had a similar characteristic in that they explained something about what was going on in the household or life of a particular sender. However, we did not interview the SMS teenagers with this focus, so it is difficult to judge. It remains to be empirically seen whether SMS practice has evolved an away-like function and if so, what its characteristics in use are.

Despite the two different styles of IM usage, one common theme emerges across the studies. Like SMS teenagers, IM users were oriented towards being available to their peers. Being online meant prioritizing talk with peers and fulfilling conversational commitments. This was emphasized in a sense of obligation to explain absences and take conversational turns, even when temporarily absent from the keyboard.

5.5 The Home Economics of Media

A few studies of SMS usage have also highlighted the perceived financial advantage of text messaging. Two parameters of cost have been identified. First, the difference in cost between making a voice call and sending a text message has been identified as a reason to send text [Ling 2004]. Second, our own study highlighted how teenagers liked the ability to determine in advance how much a conversation would cost, and voice calls, with their open-ended nature, were much harder to control financially than a fixed cost text communication [Grinter and Eldridge 2001].

In this analysis, the SMS data also highlighted something else about cost of usage. It was clear to all the teenagers that there were costs not just associated with device ownership, but also with device usage. All the teenagers were able to describe the financing of their pay-as-you-go telephone plans, since in all but two cases they were now managing all the day-to-day costs of mobile usage.

Costs associated with IM usage were harder for the teenagers to articulate. None of the broadband users could provide us with any details about the cost

of IM use. While they all knew that the clients were free and their parents paid for the computer and connection, few knew the precise nature of these costs. Moreover, since the costs for broadband were typically fixed by a flat rate fee that depended on what upload/download speed a customer selected rather than "number of bits moved," there was little ability on the part of parents to monitor for lots of traffic versus none.

The costs of IM use were clearer to those who used IM through a dial-up connection. Although the parents, like those of broadband IM users, assumed the costs of the connection, the phone bill made these costs much more visible through charging by calls made. Specifically, these teenagers exhibited acute sensitivity to not overusing the landline for Internet access, even though it often competed with their desire to spend more time online. This awareness of a usage threshold came up because many teenagers described coming very close to having to pay either part or all of the entire phone bill when a parent decided that the costs had risen too high. Like their SMS counterparts who sought the cheapest medium to maximize their fixed income, the IM teens did not want to have to eat into their own resources to pay for excessive usage, nor did they want their families to recalibrate what reasonable usage was.

So, the majority of teenagers' attention to financial costs was associated with usage costs, rather than the initial (purchase) costs of both IM and SMS. Perhaps this is not surprising, given that the vast majority of teenagers in both studies had not borne the purchase costs of the hardware required to use SMS and IM. In the case of SMS, parents had typically paid the full cost of the phone up front (which is required in most pay-as-you-go plans). The IM teenagers had not purchased their own computer or contributed to the shared costs of a family machine.

However, this being said, teenagers could still see and talk about the finances required to purchase telephones and computers. A number of teenagers described how their parents had reviewed various phones, phone plans, or computers when deciding what to purchase. Especially in regard to phones, parents factored in the potential savings of having all family members using the same service, typically reducing voice and text message costs.

6. DISCUSSION

In the previous section, we described similarities and differences between SMS and IM use. We described the types and styles of SMS and IM use, the relationship between potential and actual contacts, the independence provided by both technologies, the expectations of availability, and the financial costs associated with usage. In this section, we build on these findings to examine how differences at the application and infrastructure level shape usage patterns, the mechanisms that teenagers use to manage their privacy, and the use of SMS and IM in concert to provide awareness and coordinate communication.

6.1 Application and Infrastructure: Contrasting SMS and IM

When contrasting SMS and IM, the underlying social reasons that teenagers have for using either technology appear uniform. SMS and IM provide new

means for peer communication at a time in teenagers' lives when they have a heightened interest in forming their identity [Giddens et al. 2003]. Talking with peers provides an important forum for establishing who a teenager is (self identity), as well as understanding how he/she fits into broader groups (social identity). SMS and IM not only make this type of interaction possible, but also allow teenagers to experiment and manipulate the boundaries of these identities as necessary.

On closer examination, one set of differences in usage practices emerges from the subtle difference in technical features. One obvious source of difference comes from the applications themselves. For example, at the time of many of the earliest studies of SMS usage, the technology did not support n-way conversation or the integration of multiple media into the conversation. IM, by contrast, let teenagers chat in groups as well as individually, and enrich their conversations through the integration of a variety of media. Consequently, SMS conversations tended to be to be purely textual (with the addition of some of the symbols known to email communications), while IM conversations could be characterized as richer (incorporating links, QuickTime movies, and images).

Another application-level difference was the burden imposed on IM users by the lack of compatibility among applications. SMS users did not need to know what service their friends had in order to know whether they could send them messages, since messages crossed service providers seamlessly. By contrast, IM users had an initial start-up cost associated with selecting an application that their friends were also using. This was a particular challenge for the teenagers who had changed schools, and could easily find themselves with two sets of friends "locked" into two different applications. A few IM clients existed, even at the time of the study, which allowed an individual to chat with buddies on multiple systems seamlessly, but they were not in widespread use at the time of the interviews.[3]

Beyond the applications themselves, comparison of SMS and IM highlights the hardware (form and costs) and infrastructural differences that also influence usage. By infrastructure, we mean the networking required to use the Internet. In the home, both the hardware and infrastructure (the landline telephone) seemed more visible than they are in the office, and this visibility had implications for IM usage. Most directly, in order to use IM, teenagers had to negotiate permission to use both the computer and the telephone line. In contrast, SMS, integrated into a mobile phone with its built-in always-on network connection, was routinely available to teenagers without familial negotiation.

More indirectly, the hardware and infrastructure tended to tether the computer in ways that the mobile phone did not. For example, the presence of the family computer in a semi-public space in the home, such as the living room, created additional usage challenges for teenagers wishing to have private conversations. In addition to tethering use in a physical sense, the separation of

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[3]In our study of IM, we found that the multisystem clients tended to be used by those teenagers with more "advanced" knowledge of computers, typically boys who were enthusiastic programmers. Perhaps this stems from the presence of some of these clients as OSS projects.

hardware and infrastructure also limited use due to the need to own (or at least temporarily control) all components in order to achieve continuous usage. Those fortunate continuous-sporadic IM users were the few who had their own computer and access to an always-on DSL connection that began to give them the same permanent availability as the SMS users.

From the earliest studies of electronic communications, media choice has been a central topic. The question of why an individual selects a particular medium for a given interaction has been the focus of many analyses. Given the initial uptake of many electronic communication technologies in the support of work, media choice often examined office-based communications. Moreover, there was little need to study the home from a media choice perspective, since the only (two-way) electronic communications technology available was the telephone. The arrival of the computer and mobile phone into people's homes has changed the domestic media landscape in a few short years by providing a variety of electronic communications options.

Throughout the previous sections, we have identified a variety of reasons that teenagers choose SMS and IM, such as the "silence in use" property and financial costs. Beyond these reasons, media choice also seems to turn on integration at both the application and hardware-infrastructural level. In the case of IM, applications and communications are tightly bound together; knowing how to respond when someone says "IM me" requires knowing what system they plan on using.

At the hardware-infrastructural level, the choice to use a certain media becomes quite a commitment. In particular, when the network infrastructure required to use the application is distinct (a resource in its own right) from the hardware, then the choice to use the technology becomes a commitment to secure permission to use all resources simultaneously. Added into this mix is the challenge posed by the ability to examine the costs of these separated infrastructural resources, such as the phone bill associated with Internet dial-up. Also, the combination of availability of infrastructure (a local phone jack) and the costs of hardware (and how many computers a family has) plays an important role in determining ownership and location. Individually owned and privately located machines are more desirable—in our IM interviews, we were struck by how many teenagers talked about their future as one of owning their own computer and getting an always-on connection.

In conclusion, contrasting SMS and IM usage makes the infrastructure that supports the differences in use between both technologies more visible for examination [Star 1999]. One finding that differs from Star and Ruhleder's [1996] analysis of the scientific worm community is the degree of transparency of infrastructure. They argue that only when infrastructure ceases to work, such as when a server needs rebooting, does the infrastructure become visible. At home, the computer seems more visible than in the office. Computer visibility in turn has exposed a previously unseen infrastructure—the landline telephone—and turned it into a more complex and potentially overloaded resource. Moreover, although the current visibility may recede as more people acquire an always-on Internet connection that can be configured and forgotten, it seems likely that other types of network technology, such as the firewall needed to protect any

computer on an always-on Internet-connected network, will then begin to make their own presences felt [Grinter et al. 2005]. Accomplishing transparency in network infrastructure (especially Internet-style networks) will become a significant challenge for human-computer interaction in the age of ubiquitous computing [Edwards and Grinter 2001].

6.2 Availability, Socially Appropriate Access Control, and Usable Security

Previously, we described how teenagers use IM to make themselves available to their buddies, even when events call them away from the computer. We suggest that teenagers using either SMS or IM feel an obligation to be available to their friends for conversation. This being said, all the teenagers in both studies described times and situations where they wanted to be unavailable to specific people or more generally. Across both datasets, we noticed the younger teenagers, in particular, describing highly fluid patterns of friendship where people come and go from the social inner-circle rapidly and routinely.

In our first analysis of the IM data we described this need for privacy in detail. Following Palen and Dourish's [2003] idea of privacy as the ongoing maintenance of boundaries, we argued that IM teenagers used the technological features of the system for privacy management. In this section, we briefly review these mechanisms, and then discuss a reanalysis of the SMS data to understand how teenagers managed their boundaries with this technology. We then go on to discuss the relationship of privacy management to usable security, an emerging HCI research agenda.

The teenagers described two types of strategy for managing their availability: *technical features* and *technological faults*. Teenagers used two technical features of IM, away messages and blocking, to manage their boundaries. Away messages such as "working on assignment" helped to set boundaries. The IM blocking feature helped teenagers establish boundaries by appearing offline to people they did not want to communicate with. Specifically, blocking allows an IM user to list buddies that they do not want to receive IM messages from; to the blocked person, the blocker simply appears to be offline. Obviously, an individual can use blocking to avoid conversations with another person. We also heard accounts of blocking being used by groups of teenagers to effectively shun a person who was not in the "in-group" currently.

SMS does not provide the technical features that make it possible for teenagers to establish accounts of their unavailability. Instead, the teenagers described how they used technological faults to establish these same types of boundaries. The difficulty some telephones have in receiving signal inside of buildings was one type of account they described using to avoid a timely response to a message. Another, but less frequently used, account was to claim that their phone had not received the message. While a vast majority of SMSes make it to their final destination, an inevitable few either get significantly delayed or completely lost. This small percentage of errors provided a useful cover for a lack of response.

Technical features and technological faults allow teenagers to manage their availability by providing *plausible deniability*. Teenagers can say that they were

not online or were out of reach, or did not respond to a message because they were busy or did not get it. The strategies also highlight the fact that the relationship between availability and privacy is one of access control, particularly socially acceptable access control.

The question of how to provide access control has long been familiar to security researchers. One common embodiment of their solution to this problem is known as the access control list. While providing detailed control over who can see and use which resources, ACLs have had mixed results in practice [Zurko and Simon 1996]. One reason why people may not have adopted ACLs as hoped is that they do not fit into the social practices that surround access control, and yet despite this, little has been done to correct this omission (but see Stevens and Wulf [2002] for a study that addresses this gap).

This may change due to renewed interest within both the HCI and security research traditions in how to make security usable (see Cranor and Garfinkel [2005] for a collection of contemporary and classic articles that cover a wide spectrum of HCI and security research).[4] The presence of plausible deniability in the use of both SMS and IM as a means to regulate privacy has a number of contributions to make to this developing research area.

First, plausible deniability as a means by which people accounted for their absence or lack of response suggests that access control is a highly social activity. These teenagers wanted and took advantage of both technological features and failures to manage their availability in subtle and complex ways that suited their on-going and ever-changing needs. At the same time, they did not want to have to account for the nuances of their choices. They wanted to block, without being seen as doing so.

Second, plausible deniability provides a potential outcome through which to analyze the provision of access control solutions. Today's ACLs often attempt to design for every access condition. Plausible deniability might allow the removal of many system settings in favor of allowing end-users to "fill in the gaps" with social accounts that provide them with a variety of options in the social space.

Third, plausible deniability illustrates how security decisions are often a collaborative process [Dourish et al. 2004]. Currently, many security systems are designed with a single user in mind: the person making the access decision. However, people make security decisions with others in mind, whether it be the "wily hacker" or in the case of this study, the desire to temporarily cut off a currently unpopular friend from group conversation. Making these other parties explicit in the access decisions made might be one way to make security more meaningful for end-users.

This reanalysis shows how technology features and technological limitations allowed their users to manage their appearance to others. As technologies become an increasing part of our nonworkplace life, access control issues will take on increased significance. In particular, the provision of technology features, such as blocking (especially in the absence of technological failure modes), that

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[4]We say "renewed" because in 1975, the two security researchers, Jerome Saltzer and Michael Schroeder argued that "psychological acceptability" was one of their design principles of computer-based information protection [Saltzer and Schroeder 1975].

help end-users manage their privacy in socially appropriate ways is a critical challenge for home system design. Most importantly, these features will need to be designed such that end-users can understand and use them without the intervention of a systems administrator.

6.3 Microcommunication and Awareness: SMS and IM in Concert

Throughout this article, we have contrasted SMS and IM usage. In this section, we describe the use of these two technologies in concert. As homes become a focus for research and commercial technological deployment, so the potential for multiple media to be used in conjunction rises. Unsurprisingly, teenagers, with their insatiable enthusiasm for communications technologies, have already begun to find uses for multiple technologies that they use collectively.

In our study of SMS-using teenagers, we were not surprised to learn that all of them also use IM as well. Indeed, what we learned about their IM usage (through background questionnaires, and what they said about IM in their logs and the interviews) seemed much like the IM users described in this article. However, the analysis of their reports that featured the use of both technologies provided an explanation for a form of SMS traffic that we had observed.

Specifically, in our SMS study we were surprised to find that almost a quarter of all the reported message traffic was focused on communications [Grinter and Eldridge 2003]. These messages took the form of trying to arrange times to communicate via other media. We call this genre of message type *microcommunication* because it builds on the idea of Ling and Yttri's [2002] microcoordination, but in this case, the activity is the *coordination of communication*.

Analysis of the message content and supplemental interviews revealed that microcommunication was typically being caused by a clash between the desire to be present and available to peers, while simultaneously needing to negotiate access to various resources in the house. For example, consider the following SMS exchange we logged as microcommunication:

—B5 suggests IM, because he's dialled up to the computer (so no phone calls are possible to his household right now)
—G3 replies that she can't use the computer right now because her sister's logged on
—B5 responds suggesting a later time
—G3 says that she will see whether she can book the computer for that

After exchanging these four SMS messages, the participants later exchanged another two to synchronize media across their households. Discussions with the teenagers revealed just how difficult they found resource negotiation. This was especially true in households with multiple teenage children and only one family computer and telephone line. Teenagers reported that their parents had devised priorities and schedules prioritized by a combination of need (school or business work before recreational use) and age (those with earlier bedtimes could use the computer before those with later deadlines). This desire to use the computer and then make use of IM seemed to create the most challenging resource contention issues.

Resource contention was one significant reason for microcommunication among teenagers. Adding to the challenge was that for communication to occur, teenagers in multiple households all had to simultaneously negotiate access to the same resources. As the preceding message exchange reveals, an imbalance in the resources each teenager had resulted in difficulties in communication, except via SMS.

SMS was particularly well-suited to microcommunication for a number of reasons. First, it was inexpensive. Second, the expectation was that SMS messages were routinely checked, so coordination could occur nearly in real-time. Third, the mobile phone was not a shared communications resource for these teenagers, thus being the one resource that they did not have to compete for with their family. As a consequence, it was ideally-suited to providing a type of communications context for coordinating chat across multiple households.

Hence, ironically, SMS serves to provide a similar function as the awareness component of IM. When a buddy appears online, it's a sign that the teenager has acquired all the resources necessary to establish communications via instant messaging, and that now is the right time to talk. Similarly, SMS provides this function by being a resource that is essentially always available to the teenagers, and therefore, they can use it to communicate, regardless of whether it's the right time to talk, what media they have access to, and what constraints may exist.

7. CONCLUSIONS

In this article, we have analyzed the results from the SMS literature, along with a study of SMS usage, and contrasted them with the findings from a study of IM usage. Although SMS and IM are not identical technologies, both serve teenagers' communicative needs. Specifically, we described the types and styles of SMS and IM use, the relationship between potential and actual contacts, the independence provided by both technologies, the expectation of availability, and the financial costs associated with usage. The discussion built on these findings examine technical differences between the two technologies, in particular, how visibility of infrastructure influences usage, the mechanisms used to establish privacy in a highly available world, and the use of SMS and IM in concert to provide increased awareness.

Beyond building knowledge about the use of IM among teenagers, contrasting it to SMS usage serves as a valuable counterpoint. Specifically, reanalyzing the technologies with respect to each other highlights how their features (not just the application features, but also underlying infrastructural and physical properties) shape social practice. Further, by considering SMS and IM collectively, we add to an understanding about domestic communications and the role that technology plays in the household. At home, technology is being used in ways that researchers are only just beginning to understand. Routines of family life, technological choices, and the increased importance of economics all play a part in determining how technology fits into domestic life. For researchers, these new challenges will not only influence what we design as solutions, but how we gather and analyze the problems at hand.

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