Chapter 18
Bringing Media Spaces Back to the Streets

Notes on the Interplay of Research on Media Space and Mobile Communication

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Abstract In this chapter, we argue for the mutual relevance of media space and mobile communications researches. Surveying the two literatures, we note that the findings of media space research are often echoed by later mobile communication research and discuss some of the ideas they hold in common. However, mobile phones are used in a more diverse environment, both organizationally and physically. As such, research on mobile communication can be seen as not only building upon, but also significantly extending media space research. We discuss a few cases where this is true, as well as our own attempts to explore these connections through design and prototyping.

Introduction

Media spaces have had a tremendous impact on human-computer interaction (HCI) and computer-supported cooperative work (CSCW) research. The idea of conceptualizing "real-time visual and acoustic environments that span physically separate areas" (Stults, 1986) as flexible assemblages of people, technology, and practices (as opposed to technology alone) has been extremely productive. Hundreds of research papers cite the standard entry points into media space literature (e.g., Bly et al., 1993).

Given this positive impact, it is surprising to find little mention of media spaces in the fast-growing literature on mobile communication systems. For example, the standard media space references do not appear at all in the most prominent works on

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S. Harrison (ed.), *Media Space 20+ years of mediated life*,
Computer Supported Cooperative Work,

everyday use of mobile phones.[1] This is undoubtedly due, in part, to the prevalence in this area of social science researchers whose expertise lies in areas other than HCI and CSCW. However, even in the HCI and CSCW literature on mobile communication, there are surprisingly few references to media spaces. Here, the issue is more likely that the standard mental formulation of a media space as an always-on, desktop-based audio/video environment does not seem to have much relevance to mobile phones – one imagines "mobile media space" to mean some kind of wearable computing system, something akin to WearComp and WearCam (Mann, 1997) or the always-on Nomadic Radio system (Sawhney and Schmandt, 2000).

Looking beyond such formulations, however, it is immediately clear that insights from media space research have much to offer to the design of mobile communication systems. After all, the *ur*-media space, Hole-in-Space, connected open public spaces rather than offices. We have tried to leverage these insights in our own research agenda, in which we have explored the question: *What does it mean to have an "off-the desktop" media space*?

In this chapter, we make a case for the mutual relevance of media space and mobile communications research. We first discuss the connections between media space and mobile communication research. We then describe how we have tried to take advantage of the legacy of media spaces in our own research agenda in mobile communication – to bring media spaces back to the streets of their origin.

Media Spaces and Mobile Phones

We asserted above that media space research is relevant to research on mobile communication, and vice versa. This is based on two lines of argument. First, we observe that it is quite possible to use today's mobile communication technology in a way that essentially follows the original uses of media spaces. Hence, in these usage scenarios, one would expect the lessons of media spaces to carry forward. Second, we argue that there is demonstrable overlap between the findings of these two research areas – enough that it is clear that we should be looking for more connections between the two in any case.

Can a Mobile Phone Be a Media Space?

Most descriptions of media spaces make it clear that they are configured through emergent collective practice rather than through preestablished policy, and this is typically true of mobile phone communication as well. But are not there obvious

[1] Interdisciplinary edited collections include Brown et al. (2001), Fortunati et al. (2003), Glotz et al. (2005), Goggin (2007), Hamill and Lasen (2005), Harper et al. (2005), Höflich and Hartmann (2006), Ito et al. (2005), Katz (2003, 2008), Katz and Aakhus (2002), Kavoori and Arceneaux (2006), Ling and Pederson (2005), and Nyíri (2003, 2005, 2006). Works from anthropology, communication, and sociology include Castells et al. (2007), Goggin (2006), Horst and Miller (2006), Kasesniemi (2003), Katz (2006), Kopomaa (2000), Koskinen (2007), Ling (2004), Pertierra (2006), and Pertierra et al. (2002).

key technical differences by which we can distinguish a media space from other systems? Why should we expect any similarity in use between the two?

Scanning the most frequently cited paper on media spaces (Bly et al., 1993) and other early work, one might get the impression that a media space can be technologically characterized as a system that

- Connects *fixed locations* such as office desktops
- Uses *continuous* audio and video media
- Enables both (1) awareness and (2) lightweight communication by providing *always-open channels*

Such a characterization (which does describe many uses of media spaces, such as "office shares" or "windows" between common areas) comes close to ruling out a mobile instantiation.

However, the characterization above is also an oversimplification. If one considers subsequent research on presence and awareness, a more accurate characterization of the key properties of a media space is that it

- Is associated with an *understood spatial/social context* (as opposed to fixed locations; see, e.g., the lightweight reconfigurability of the original media spaces [Bly et al., 1993]), or the mobile Awareness system [Tang et al., 2001])
- Uses *continuous or discrete media* (as opposed to continuous media alone; see, e.g., Portholes [Dourish and Bly, 1992])
- Enables (1) awareness by providing an *ongoing stream of awareness updates* and (2) lightweight communication by providing an *ongoing state of incipient interaction*

One might object that this characterization seems overbroad – after all, instant messaging, or even text messaging, one's friends frequently on a mobile phone fits this description. But again, the claim has been that the core properties of a media space lie in its use, not in the specifics of its "delivery" technology.

In considering this claim in the mobile context, it is useful to consider some of the basic ideas developed in conversation analysis (Sacks, 1984), a methodology for analyzing how human interaction is organized into sequences of action. The organization of taking turns at talk is fundamental to conversation. One of the ways in which turn-taking organization operates is by specifying opportunities for *speaker change* at *turn-constructional units* (TCUs) from which turns at talk are composed (Sacks et al., 1974). This enables listeners to monitor and project the completion of others' TCUs in order to time the initiation of their own turns properly. Completion of a TCU is often accompanied by a pause in speech, making a *transition-relevance place* (TRP) where speaker change may occur. Building on these basic concepts, conversation analysis describes additional mechanisms that underlie the unfolding of conversational encounters. Of particular relevance to us here is a concept of a "continuing state of incipient talk" (Sacks et al., 1974) that differs notably from a single, focused conversational encounter (Fig. 18.1, top). Once participants in physical copresence enter a state of incipient talk, they engage, disengage, and reengage (Szymanski, 1999) from talk-in-interaction without explicitly regreeting

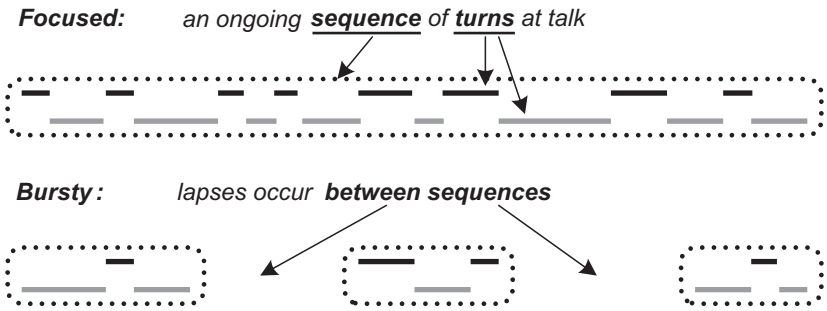

Fig. 18.1 Focused interaction versus interaction in a state of incipient talk

each other, reintroducing themselves, or otherwise re-"opening" the conversation. Interaction proceeds in a "bursty" fashion, with lapses occurring between spates of talk (Fig. 18.1, bottom).

Copresence is not necessary to a state of incipient talk. We know that physical copresence is not necessary as similar states are described in media space research such as that on the Interval Research series of audio-only media spaces (Ackerman et al., 1997). Indeed, virtual copresence (in the form of an always-on channel) is not necessary as similar states have also been observed in the use of instant messaging (Nardi et al., 2000) and mobile push-to-talk voice messaging (Szymanski et al., 2006). Open audio and video channels may make some aspects of the experience more lightweight, since one does not have to compose messages. However, in creating a sense of presence and awareness, it is more important for the network to be available than for data to be passing through it at all times. In other words, "always on" in the network-level sense (always connected to the network) is more critical than "always on" in the application-level sense (always running). It is important for mobile communication researchers to understand this point, because it makes clear why the experience gained from media space research often apply in this domain as well.

The Interplay of Media Spaces and Mobility

If one accepts that media space research and mobile communication research ought to have mutual relevance, the natural question is: what is this relevance? We argue that the earlier research on media spaces serves as a useful conceptual foundation for a great deal of mobile communication research, and further suggest that many general phenomena described in the last 2 decades of media space research have in some sense been rediscovered in the last 5 years of work on mobile phones. However, it is also true that the understanding gained of the nuances of mobile communication practice extends and refines the insights gained from media spaces as well. It could hardly be otherwise when one considers how connectivity has

extended from the workplace into everyday life, and the great increase in expectations of connectivity (Ito and Okabe, 2005; Ling and Yttri, 2002). By way of example, we detail a few areas of commonality below.

Sustaining Relationships

One area of commonality is a predominance of use for coordination and awareness within relatively small, preexisting groups. It has long been clear that media space is a tool for *sustaining* relationships (Bly et al., 1993, p.42) – that initial trust is necessary for stable sharing practices to develop, and that this trust occurs most readily in already-formed groups. Given that, it is arguably unsurprising that, across societies, mobile communication is overwhelmingly used to maintain existing relationships within small groups (Habuchi, 2005; Ito and Okabe, 2005; Ling and Yttri, 2002; Matsuda, 2005; Woodruff and Aoki, 2003). Although one frequently sees empirical reports of overflowing contact lists, it is also typically found that the bulk of mobile phone interaction occurs within core groups of 10 or fewer. This is captured by notions such as "full-time intimate community" (Nakajima et al., 1999, cited in Matsuda, 2005), "tele-cocooning" (Habuchi, 2005), and "selective sociality" (Matsuda, 2005).

In both cases, what passes through channels is often classic "phatic" communication (Malinowski, 1922) – intermittent and often unimportant and uninformative in itself – but the commitment to availability in itself reinforces relationships (Simmel, 1950 [1910]). Further, even if awareness updates – seeing a coworker in an office, receiving a text message from a friend complaining, "I'm tired" – do not provide immediately relevant or actionable activity awareness, updates from members of the group over time can provide "local resources" for talk, material for "noticings" in subsequent interaction (Sacks, 1992, pp.87–97), and "arrangement tokens" that span multiple interactions (Button, 1991).

In the mobile case, notions such as "full-time intimate community" and "ambient virtual copresence" (Ito and Okabe, 2005) do differ from prior notions in degree. Mobile communication extends into everyday, on-the-street life, and core groups are typically made up of friends (as opposed to coworkers – who might be, but need not be, friends). Indeed, a key reported use of mobile communication is maintaining connections with friends who one no longer sees regularly at school or at work (Matsuda, 2005).

Keeping Company

A second area of commonality is the ability to enable a particular kind of presence or "connectedness." Users of the original PARC media space – users who were not collaborators – were observed connecting their offices to keep each other company while working at night (Bly et al., 1993, p.39). Mobile phone users have been observed making periodic contact (e.g., updates by mobile e-mail) with selected friends to create a sense of connectedness as they go through their daily

routine (which for city dwellers often involve extended periods of walking or travel on public transportation) (Ito and Okabe, 2005). In our own design fieldwork of users of mobile push-to-talk, we have observed what we termed "extended remote presence" (Woodruff and Aoki, 2003), or intermittent communication with a specific "companion" while in transit or doing errands – a way of creating an audible version of what Goffman (1971) called a "with" through the use of mobile communication.

In both cases, as in the previous subsection, the contact need not be continuous or particularly informative in a semantic sense. It is the implicit commitment by a specific person or persons to availability for an extended period (rather than a general sense of availability within a group) that creates this kind of connectedness.

In the mobile case, the sense of connectedness is threatened by several challenges that do not arise (or arise to a much more limited degree) in the media space case. One set of challenges has to do with obstacles to the use of mobile communication in different physical environments that arise from social sanctions, legal restrictions and physical safety implications (see, e.g., Paragas, 2005). These vary not only across societies, but also when one moves through (e.g.) a city. A second set of challenges has to do with finding suitable partners. A media space provides relatively simple mechanisms for browsing for active system participants; more abstract presence mechanisms, or an absence of presence mechanisms altogether, can reduce users to "polling" their friends to find "companions" (e.g., Woodruff and Aoki, 2003).

Temporality

A third area of commonality relates to awareness of temporal rhythms and patterns. Such awareness is a key resource (along with explicit presence data) in knowing whether it is appropriate to make contact. This appears in at least two different forms that work on different time scales. The first involves synchronic events, typically on a diurnal scale. In the PARC media space studies, a wave and a "good morning" and "good night" would be sent through the media space (Bly et al., 1993, p.39). Similarly, "good morning" (Taylor and Harper, 2003) and "good night" (Grinter and Eldridge, 2001) messages are often reported in mobile phone studies, particularly those of text messaging. These let others know that one is "signing off" from contact. The second involves detailed understanding of daily routines. Individuals within work groups who are able to observe each other (whether through media or copresence) are able to form mental models of each others' schedules and potential availability (Begole et al., 2002). Similarly, in a college environment, students' schedules may be very structured in the sense that friends have detailed awareness of each others' class and work schedules (Woodruff and Aoki, 2003).

In both cases, users can gather information about each others' activities by passive observation (watching or listening) or active information sharing. Where awareness/presence information is ambiguous (as is usually the case with buddy-list-like presence mechanisms) or is updated on an infrequent or irregular basis, difficulties can arise in interpretation.

In the mobile case, practices around temporality may diverge from those seen in conventional media spaces. First, users may simply accept more interruptions. Because awareness in the mobile case is much less likely to be based on high-fidelity observation (e.g., video) and more likely to be irregularly updated (e.g., manual text messages, or presence information based on handset status), it is recognized that predictions of others' availability may be unreliable. Second, users may develop graduated contact strategies that involve communication media that are less "interruptive." In most societies, textual communication media are considered less of an interruption than a voice call; the practice often arises of texting before calling.

Discussion

This section contributes nothing new in a strictly empirical sense. That is, the phenomena discussed – use for sustaining relationships, use for keeping company, and the role of temporality in activity awareness – are well known in media space research and visible to varying degrees in mobile communication research.

What we illustrate here is that there are many concrete connections between the two research areas that become evident when one views media spaces in the generalized sense described in the preceding subsection. Media space research identified some specific connections – e.g., the relevance of earlier desktop work on presence to mobile presence, as in Tang et al. (2001) – but the generalized view enables one to see how users of mobile communication systems have systematically produced many of the same emergent practices as did the users of media spaces.

Social, Mobile Audio Spaces

Having discussed a few of the ways in which media space and mobile communication researches can interact in the context of empirical research, we now turn to the question of how this might be accomplished in the context of design. In this section, we provide an overview of our own mobile communication project. In doing so, we illustrate some of the ways in which this project has drawn inspiration from media space research.

From a design perspective, our point of departure becomes obvious from the project name: social, mobile, and audio spaces (http://www.parc.com/audiospaces/). From the beginning, we explicitly focused our design efforts in three ways:

- *Social*. Our design goal is to facilitate sociable interaction within small groups. This focus draws direct inspiration from the emergent uses of mobile communication described in the previous section rather than from workplace interaction alone.
- *Mobile*. A great deal of "mobile" technology use is actually portable technology use (consider the typical uses of laptop and handheld computers). However, choosing to enable mobile, "on-the-go" scenarios such as "talking while walking"

implies an emphasis on eyes-free and hands-free use and a prioritization of non-visual interaction modalities (e.g., of audio over text or video).
- *Audio spaces*. By alluding to the Interval Research series of "audio-only media spaces" or *audio spaces* (Ackerman et al., 1997), we indicate a common emphasis on lightweight audio interaction. That is, the desired interaction model should resemble an audio space in the degree of spontaneity that it enables rather than resembling a telephone call.

However, mobility on-the-go constrains this design space in the sense that exposing one's face-to-face interactions through wearable, always-on media streaming (Mann, 1997) is not desirable for most people as well as problematic in many social settings.

From a social science perspective, we explicitly framed our research in terms of interactional engagement, albeit at several levels of granularity. Our previous research on wirelessly connected museum audio guides (Aoki et al., 2002) had taught us the importance of managing transitions between levels of engagement. Our experience had been that we could design mobile systems that engendered states of connectedness and activity awareness within small groups through wireless audio sharing. However, it also showed us that it was difficult to get people "back" into a state of engagement once they began to pursue separate activities. These kinds of transitions would clearly be quite frequent in anything that aspired to be a "social, mobile audio space."

Drawing on our prior research and on our design fieldwork conducted using mobile push-to-talk "radios" as an approximation of a future lightweight audio communication system (Woodruff and Aoki, 2003), we engaged in a variety of design-oriented explorations of the processes of engagement, disengagement, and reengagement of interaction. These explorations included the following.

- Managing engagement of floor participation *within a given conversational encounter* (Aoki et al., 2003, 2006)
- Managing engagement *within a state of incipient talk* (Szymanski et al., 2006; Woodruff and Aoki, 2003; Yu et al., 2004)
- Managing engagement *within the context of a social relationship or association* (Aoki and Woodruff, 2005)

The first two were developed the furthest, and we discuss each in turn in the following sections.

Within a Conversational Encounter

If multiple mobile users want to be able to "keep each other company" as described above, what needs to change in audio communication technology for such users to be able to hold spontaneous conversations in an audio space? Is sociable interaction within a small group, the kind that is such a key part of the "sustaining relationships"

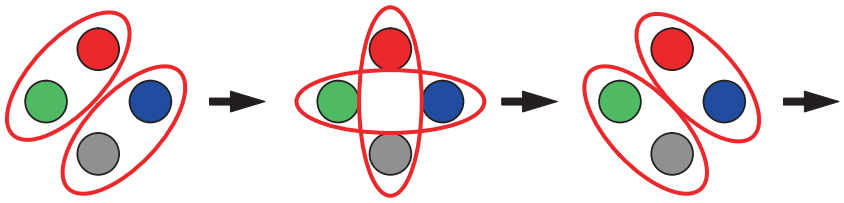

Fig. 18.2 Participation in multiparty interaction changes over time

described above, different from other kinds of conversation – and if so, how can we support and facilitate such interactions?

In approaching these questions from a design perspective, we first needed to understand what kinds of sociable interactions might need to be supported. For example, consider the fluidity of casual conversation around a dinner table or at a cocktail party. A salient feature of such events is the occurrence of *multiple simultaneous conversations* (Egbert, 1997; Sacks et al., 1974) in which membership changes over time (Fig. 18.2). Anyone who has experienced a disorganized conference call knows that this is clearly not something that is well-supported by off-the-shelf conferencing technology, as simultaneous speech on a phone line is nearly unintelligible.

In addition to the previously mentioned design fieldwork (Woodruff and Aoki, 2003), we conducted a series of studies of small-group talk to identify key phenomena of sociable interaction (Aoki et al., 2003, 2006). We knew that detailed examinations of interactional practices in media spaces had been carried out in the past. For example, studies of interactions in the original PARC media spaces had uncovered problematic aspects of video mediation of collaborative activity (see, e.g., Heath et al., 1997). Casual workplace interactions in the interval audio spaces had been examined as well (Ackerman et al., 1997). However, the kinds of settings and problems in which we were interested had not been examined before; designing technology to facilitate phenomena such as multiple simultaneous conversations would clearly require very specific characterization of the phenomena in question.

Our studies drew upon the research and methods of conversation analysis. As mentioned above, conversation analysis is the study of the sequential organization of interaction. Empirical research has characterized the normative duration of pauses in two-party conversation and has also indicated that sustained periods of *simultaneous speech* are infrequent. Multiparty conversations of the kind with which we are concerned may have a single *floor* in which participants orient to each others' turn-taking behavior as just described. However, in casual multiparty conversation, s*chisms* (Egbert, 1997) may occur frequently, a dynamic process in which conversations merge and new conversations arise.

For our initial design exploration, we decided to focus on enabling multiple simultaneous conversations using only the capabilities of a conventional mobile phone. We built a prototype multiparty audio space using wireless handheld computers

and a custom audio-mixing system (Aoki et al., 2003). Drawing on the conversation analytic results above, we enhanced the audio mixer with a machine learning component that analyzes participants' turn-taking behavior to identify distinct conversational floors as they emerge, noting which participants are associated with which floor (c.f. Fig. 18.2). The system dynamically modifies the audio delivered to each participant to enhance the salience of the participants with whom they are currently conversing and to reduce the salience of the participants with whom they are not currently conversing. Each participant therefore receives a customized mix of all floors, tailored to their current conversational status.

The main observation is that when two simultaneous conversational floors are on-going, participants associated with one do not orient to the turn-taking organization of the other. This has two implications: (1) speakers in one conversation no longer align the initiation of their TCUs with the TRPs of the other conversation, and (2) speakers in the distinct conversations overlap their talk much more than if they were participating in a single floor. These implications form the basis for the mixer's machine learning component. The floor assignment subsystem continually determines the most likely configuration of conversational participants from the content of the audio streams. It runs a voice activity detector on each incoming audio stream, producing binary classifications (speech/nonspeech). It then extracts temporal features from each pair of binary streams (TRP positioning for speakers A and B is the distance between the starting point of A's most recent utterance and the endpoint of B's utterance that mostly closely precedes A's utterance; simultaneous speech is the amount of overlap between A's and B's utterances during a given time period). A classifier outputs probabilities of mutual floor participation for each pair of users; it considers these probabilities in view of a model of valid floor configurations, choosing the most likely configuration. The chosen floor configuration is used to set how speaker A's audio is presented to speaker B. In the current system, if A and B are participating in the same floor, then they hear each other at a "normal" volume level. Otherwise, they hear each other at a "quiet" volume level (currently 20% of the "normal" level). As a result, every participant in the audio space hears a customized mix.

In summary, we found that detailed consideration of the processes of engagement, disengagement, and reengagement *within* a conversational encounter led us in interesting and fruitful directions, both in terms of producing new technical ideas for augmenting conventional media space designs (Aoki et al., 2003), as well as producing new results in social science (Aoki et al., 2003, 2006).

Within a State of Incipient Talk

There is a growing array of mobile communication technologies – full-duplex voice, half-duplex push-to-talk voice messaging (Fig. 18.3), text messaging, etc. – each with its own uses and affordances. For example, mobile telephony is well-suited to bounded, relatively focused interaction between two participants

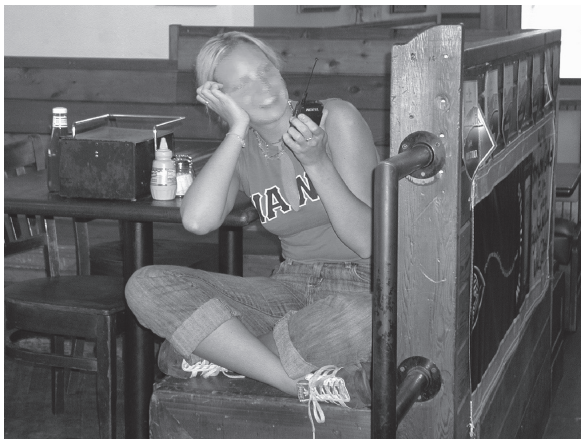

Fig. 18.3 "Walkie-talkie" interaction over push-to-talk mobile voice

(as in Fig. 18.1, top); message-oriented systems such as instant messaging and push-to-talk voice messaging are well-suited to longer interactions that proceed in bursts (as in Fig. 18.1, bottom). How should users choose between them? As the degree of engagement changes over time, is the medium used to begin an interaction the right medium to continue, or is explicit "media-switching" (Nardi et al., 2000) always the right answer?

Our design fieldwork suggested that media-switching is more problematic than one might think. For example, in our studies of push-to-talk voice messaging, users continued interactions in the initial medium even when a "media switch" seemed warranted (Woodruff and Aoki, 2003). And indeed, analyses of interaction in prior media spaces provided some hints of relevant issues. In the original media space research, it had been noted that visual gestures intended to initiate interactions during a state of incipient talk often failed (Heath et al., 1997). (Working at PARC, we had also observed that long-time users of the Kasmer media space [Bly et al., 1993] made frequent transitions between video-only and audio/video communications but that, similarly, often failed).

The points above suggest that "smoothing" the media-switching process may be an opportunity for technological intervention. Research in pragmatics (Selting, 1994) and conversation analysis (Goodwin and Goodwin, 2000) suggests that there are prosodic elements of speech that indicate heightened conversational engagement. If we could construct a system to estimate the level of the users' engagement in an ongoing remote conversation, e.g., by drawing on research on detecting emotion in human speech (Cowie et al., 2001), we could use these estimates to modify the communication system in useful ways. For example, if two users are speaking in a push-to-talk audio session and become highly engaged, the system could switch over to a telephony (duplex audio) connection.

To understand some of the issues behind these questions, we have conducted machine learning experiments in which we attempt to differentiate between states of conversational engagement and nonengagement using acoustic features extracted from audio (Yu et al., 2004). These experiments, while preliminary, have

had a degree of success comparable to that of similar studies of emotion recognition from audio (Scherer, 2003).

Discussion

While we have discussed (briefly) some design, prototyping, and social science activities, the framing of the various problems has been rooted in the deep explorations of presence, awareness, availability, mediated communication, and small-group dynamics pioneered by the research on media spaces. We suggest two related areas that are open for additional research.

The first area concerns the evolution of one's social groups over time, as described in the preceding section. When mobile users wish to prune their contact lists, what resources are available to them? One's sphere of frequent social contact evolves over time, but once contact information has been exchanged, how does one disengage from such people? Our design fieldwork (as well as that of others) suggests that it is difficult to navigate the social process of avoiding unwanted interaction as one's social relations evolve. Research on workplace-oriented media spaces offers little explicit guidance. After reflection on some of the issues behind these questions, we have offered some preliminary thoughts on resources that system designers can provide to users that might be of use in such efforts (Aoki and Woodruff, 2005). Specifically, we point out that ambiguity can be a useful aspect of communication system design when it affords relevant resources for social interaction.

The second area concerns recent developments in mobility and scale. Hole-in-Space connected crowds in distant public locations and there have been countless recreations of this idea in semipublic spaces. However, the recent commoditization of data service over cellular networks has enabled video-based "lifecasting" of all of one's interactions over the Internet (a current commercial example being justin.tv). There is a sense in which lifecasting creates a somewhat covert and highly mobile version of Hole-in-Space – but one in which unidirectionality violates the communicative reciprocity that was so critical to the successes of media spaces (and unlike prior experiments in wearable computing [Mann, 1997], does so on a massive scale). Clearly, the ideas refined over the course of 2 decades of media space research can inform the debate over developments such as lifecasting.

Conclusion

Because the uses of media spaces and mobile phones are often similar, the findings of media space research are often closely related to those of later mobile communication research. While we have pointed out that one should not dismiss media space research as being irrelevant to mobile communication research based on spurious technological distinctions, we have also described some areas where the

findings of the earlier research have been echoed in those of the later. Some areas where common phenomena and practices have arisen include their use in sustaining relationships, in enabling remote "companionship," and in the employment of temporal patterns. However, mobile phones are used in a more diverse environment, both organizationally and physically. As such, research on mobile communication can be seen as not only building upon, but also significantly extending media space research. We have discussed a few cases where this is true, as well as our own attempts to explore these connections.

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