

Media Spaces in the Mobile World

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INTRODUCTION

Media spaces have had a tremendous impact on HCI and CSCW research. The idea of conceptualizing “real-time visual and acoustic environments that span physically separate areas” [30] 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 the media space literature (e.g., [7]).

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, in the most prominent edited collections on everyday use of mobile phones [8,10,14,15,17-19,23-25], the standard media space references do not appear at all. This is undoubtedly due, in part, to the prevalence in this area of anthropology, communication and sociology 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 canonical image of an open desktop audio/video environment doesn’t seem to have much relevance to mobile phones – one imagines “mobile media space” to mean something akin to the wearable, always-on Nomadic Radio system [29].

Looking beyond such images, however, it is immediately clear that insights from media space research do have much to offer to the design of mobile communication systems. 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 paper, we sketch out some arguments for the mutual relevance of media space research and mobile communications research. We first discuss the connections between media space research 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.

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 pre-established policy, and this is typically true of mobile phone communication as well. But aren’t there obvious 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 [7] 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, and
- enables both awareness and communication by means of *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 [7], or the mobile Awarenex system [33]),
- uses *continuous or discrete* media (as opposed to continuous media alone; see, e.g., Portholes [9]), and
- enables awareness by providing an ongoing stream of *awareness updates* and enables lightweight communication by providing an ongoing state of *incipient interaction*.

One might object that this characterization seems overbroad – after all, instant messaging, or even texting, one’s friends frequently on a mobile phone fits this description. But again, the claim is that the core properties of a media space lie in its use, not in the specifics of its “delivery” technology. Open audio and video channels do make some aspects of the experience more lightweight, since one does not have to compose messages. However, we would claim that open media channels are not strictly necessary to 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 two decades of media space research have in some sense been rediscovered in the last five 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 [16,20]. 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, pre-existing groups. It has long been clear that media spaces are a tool for sustaining relationships ([7], 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 [13,16,20,21]. 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” (cited in [21]), “tele-cocooning” [13] and “selective sociality” [21].

In both cases, what passes through channels is intermittent and is often unimportant and uninformative in itself. The commitment to availability itself reinforces relationships.

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 do provide “local resources” for talk [27], material for “noticings” in subsequent interaction.

In the mobile case, notions such as “full-time intimate community” and “ambient virtual co-presence” [16] 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 co-workers – 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 [21].

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 ([7], p.39). Mobile phone users have been observed making periodic contact (e.g., updates by mobile email) 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) [16]. In our own design fieldwork of users of mobile push-to-talk, we have observed what we termed “extended remote presence” [35], or intermittent communication with a specific “companion” while in transit or doing errands – a way of creating an audible version of what Goffman called a “with” [11] using 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., [26]). These vary not only across societies but even as 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., [35]).

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 ([7], p.39). Similarly, “good morning” [34] and “good night” [12] 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 co-presence) are able to form mental models of each others’ schedules and potential availability [6]. 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 [35].

In both cases, information about activities can be gathered by passive observation (watching) or information sharing. Where awareness/presence information is ambiguous (as with buddy-list presence mechanisms) or infrequently or irregularly updated, 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 use more evolved, 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.

SOCIAL, MOBILE AUDIO SPACES

Having discussed a few of the general ways in which media space research and mobile communication research can interact fruitfully, we now turn to the question of how this might be accomplished. 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 work has drawn inspiration from media space research.

From a design perspective, our point of departure becomes obvious from the name: Social, Mobile Audio Spaces (<http://www.parc.com/audiospaces/>). From the beginning, we explicitly focused our design efforts in two ways: first, by designing specifically to facilitate sociable interaction within small groups, and second, by emphasizing audio communication over visual communication to facilitate

eyes-free and hands-free mobile use (hence the allusion to the Interval Research series of *audio spaces* [1]).

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 handheld audio guides [2] taught us 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 in” once they began separate in-the-world activities.

Drawing on our prior experiences and on our design fieldwork conducted using mobile push-to-talk as an approximation of a future lightweight audio communication system [35], we have conducted a variety of explorations of the processes of engagement, dis-engagement, and re-engagement of interaction:

- Managing engagement of floor participation within a given conversational encounter [3,4]
- Managing engagement within a state of incipient talk [32,35,36]
- Managing relational or associational engagement [5]

We discuss each in turn.

Within a Conversational Encounter

If multiple mobile users want to be able to “keep each other company,” what needs to change in audio communication technology for such users to be able to hold spontaneous conversations in an audio space? Is “sociable” conversation within a small group different from other kinds of conversation?

To understand some of the issues behind these questions, we have conducted a number of applied conversation analytic studies of small-group sociable talk [3,4]. In face-to-face interactions in such social groups, conversational floors change frequently, e.g., two participants split off to form a new conversational floor, a participant moves from one conversational floor to another, etc. In our studies, we have examined the mechanics of multiple simultaneous conversational floors – how participants initiate a new floor amidst an on-going floor, and how they subsequently show their affiliation with one floor over another. It is clear that the practices that participants use in face-to-face conversation are disrupted in a monaural audio conference environment, not just because of the lack of non-verbal cues, but (more significantly) because the *cost* of speaking simultaneously is so high – overlapping speech is extremely difficult to understand through a monaural channel.

Drawing on our understanding of spontaneous talk-in-interaction, we prototyped a mobile audio space [3] tailored for the specific issues raised by sociable conversation within tightly-knit social groups. The audio space monitors participant behavior to identify conversational floors as they emerge. The system dynamically modifies the audio

delivered to each participant to enhance the salience of the participants with whom they are currently conversing.

Within a State of Incipient Talk

When mobile users are faced with a growing array of media for mobile communication – full-duplex voice, half-duplex push-to-talk voice, mobile IM, texting, etc. – each with its own uses and affordances, how should they choose between them? Is the medium used to begin an interaction the right medium to continue explicit “media-switching” [22] always the right answer?

Our design fieldwork suggests that media-switching is more problematic than one might think, with users continuing interactions in an initial medium even when a “switch” seems warranted [35]; an alternative might be to try to smooth the media-switching process. Consider that physical presence or a conventional media space can create an instance of what has been called a “continuing state of incipient talk” [28]. That is, participants, once they enter such a state, dis-engage and re-engage [31] from talk-in-interaction without explicitly re-greeting each other, re-introducing themselves, or otherwise re-“opening” the conversation. (Such states also arise in IM [22] and in mobile push-to-talk voice messaging [32,35].) If we could construct a system to estimate the level of the users’ engagement in an ongoing remote conversation, we could use these estimates to (e.g.) increase or decrease the “richness” of a communication session. For example, if two users are speaking in a push-to-talk (half-duplex audio) session and become highly engaged, the system could switch over to a telephony (duplex audio) connection. (A longer discussion can be found in [35].)

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 non-engagement using acoustic features extracted from audio [36]. These experiments, while preliminary, have had a degree of success comparable to that of similar studies of emotion recognition from audio.

Within a Relational Context

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 dis-engage from such people?

Our design fieldwork (as well as others’) suggests that it is difficult to navigate the social process of avoiding unwanted interaction as one’s social relations evolve. This is perhaps one of the most important open areas in which research on workplace-oriented media spaces has offered the least amount of 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 [5]. Specifically, we point out that ambiguity can be a useful aspect of communication system design when it affords relevant resources for social interaction.

While we have discussed (briefly) a range of design, prototyping and social science activities, we hope it has been clear how 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.

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 physically diverse environment, both organizationally and physically. As such, research on mobile communication can be seen as not only building upon but 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.

REFERENCES

1. Ackerman, M., Starr, B., Hindus, D. and Mainwaring, S.D., “Hanging on the ‘Wire’: A Field Study of an Audio-Only Media Space,” *ACM TOCHI* 4, 1 (1997), 39-66.
2. Aoki, P.M., Grinter, R.E., Hurst, A., Szymanski, M.H., Thornton, J.D. and Woodruff, A., “Sotto Voce: Exploring the Interplay of Conversation and Mobile Audio Spaces,” *Proc. CHI 2002*, ACM (2002), 431-438.
3. Aoki, P.M., Romaine, M., Szymanski, M.H., Thornton, J.D., Wilson, D. and Woodruff, A., “The Mad Hatter’s Cocktail Party: A Social Mobile Audio Space Supporting Multiple Simultaneous Conversations,” *Proc. CHI 2003*, ACM (2003), 425-432.
4. Aoki, P.M., Szymanski, M.H., Plurkowski, L.D., Thornton, J.D., Woodruff, A. and Yi, W., “Where’s the ‘Party’ in ‘Multi-Party’? Analyzing the Structure of Small-Group Sociable Talk,” *Proc. CSCW 2006*, ACM (2006), to appear.
5. Aoki, P.M. and Woodruff, A., “Making Space for Stories: Ambiguity in the Design of Personal Communication Systems,” *Proc. CHI 2005*, ACM (2005), 181-190.

6. Begole, J., Tang, J.C., Smith, R. and Yankelovich, N., "Work Rhythms: Analyzing Visualizations of Awareness Histories of Distributed Groups," *Proc. CSCW 2002*, ACM (2002), 334-343.
7. Bly, S., Harrison, S. and Irwin, S., "Media Spaces: Bringing People Together in a Video, Audio and Computing Environment," *CACM* 36, 1 (1993), 28-47.
8. Brown, B., Green, N. and Harper, R. (eds.), *Wireless World*. Springer, Berlin, 2001.
9. Dourish, P. and Bly, S., "Portholes: Supporting Awareness in a Distributed Work Group," *Proc. CHI 1992*, ACM (1992), 541-547
10. Glotz, P., Bertschi, S. and Locke, C. (eds.), *Thumb Culture: The Meaning of Mobile Phones for Society*. Transcript, Bielefeld, Germany, 2005.
11. Goffman, E., "The Individual as Unit," in *Relations in Public*, Harper & Row, New York, 1971, 3-27.
12. Grinter, R.E. and Eldridge, M., "y do tngrs luv 2 txt msg?," in *Proc. ECSCW 2001*, Kluwer, Dordrecht, the Netherlands, 2001, 219-238.
13. Habuchi, I., "Accelerating Reflexivity," in Ito, M., Okabe, D. and Matsuda, M. (eds.), *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life*, MIT Press, Cambridge, MA, 2005, 165-182.
14. Hamill, L. and Lasen, A. (eds.), *Mobile World*. Springer, Berlin, 2005.
15. Harper, R., Palen, L. and Taylor, A. (eds.), *The Inside Text*. Springer, Berlin, 2005.
16. Ito, M. and Okabe, D., "Technosocial Situations: Emergent Structuring of Mobile E-mail Use," in Ito, M., Okabe, D. and Matsuda, M. (eds.), *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life*, MIT Press, Cambridge, MA, 2005, 257-273.
17. Ito, M., Okabe, D. and Matsuda, M. (eds.), *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life*. MIT Press, Cambridge, MA, 2005.
18. Katz, J.E. and Aakhus, M.A. (eds.), *Perpetual Contact*. CUP, Cambridge, 2002.
19. Ling, R. and Pederson, P.E. (eds.), *Mobile Connections*. Springer, Berlin, 2005.
20. Ling, R. and Yttri, B., "Hyper-coordination via Mobile Phones in Norway," in Katz, J.E. and Aakhus, M.A. (eds.), *Perpetual Contact*, CUP, Cambridge, 2002, 139-169.
21. Matsuda, M., "Mobile Communication and Selective Sociality," in Ito, M., Okabe, D. and Matsuda, M. (eds.), *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life*, MIT Press, Cambridge, MA, 2005, 123-142.
22. Nardi, B.A., Whittaker, S. and Bradner, E., "Interaction and Outeraction: Instant Messaging in Action," *Proc. CSCW 2000*, ACM (2000), 79-88.
23. Nyíri, K. (ed.), *Mobile Democracy: Essays on Society, Self and Politics*. Passagen, Vienna, 2003.
24. Nyíri, K. (ed.), *Mobile Understanding: The Epistemology of Ubiquitous Communication*. Passagen, Vienna, 2006.
25. Nyíri, K. (ed.), *A Sense of Place: The Global and the Local in Mobile Communication*. Passagen, Vienna, 2005.
26. Paragas, F., "Being Mobile with the Mobile: Cellular Telephony and Renegotiations of Public Transport as Public Sphere," in Ling, R. and Pederson, P.E. (eds.), *Mobile Communications*, Springer, Berlin, 2005, 113-129.
27. Sacks, H., *Lectures on Conversation, Vols. I & II*. Blackwell, Oxford, 1992.
28. Sacks, H., Schegloff, E.A. and Jefferson, G., "A Simplest Systematics for the Organization of Turn-Taking for Conversation," *Language* 50 (1974), 696-735.
29. Sawhney, N. and Schmandt, C., "Nomadic Radio: Speech and Audio Interaction for Contextual Messaging in Nomadic Environments," *ACM TOCHI* 7, 3 (2000), 353-383.
30. Stults, R., *Media Space*. Systems Concepts Lab, PARC, Palo Alto, 1986.
31. Szymanski, M.H., "Re-engaging and Dis-engaging Talk in Activity," *Language in Society* 28, 1 (1999), 1-23.
32. Szymanski, M.H., Aoki, P.M., Vinkhuyzen, E. and Woodruff, A., "Organizing a Remote State of Incipient Talk: Push-to-Talk Mobile Radio Interaction," *Language in Society* 35, 3 (2006), 393-418.
33. Tang, J.C., Yankelovich, N., Begole, J., van Kleek, M., Li, F. and Bhalodia, J., "ConNexus to Awarenex: Extending Awareness to Mobile Users," *Proc. CHI 2001*, ACM (2001), 221-228.
34. Taylor, A.S. and Harper, R., "The Gift of the Gab?: A Design Oriented Sociology of Young People's Use of Mobiles," *CSCW* 12, 3 (2003), 267-296.
35. Woodruff, A. and Aoki, P.M., "How Push-to-Talk Makes Talk Less Pushy," *Proc. GROUP 2003*, ACM (2003), 170-179.
36. Yu, C., Aoki, P.M. and Woodruff, A., "Detecting User Engagement in Everyday Conversations," *Proc. ICSLP 2004* (2004), 1329-1332.