Time to meet face-to-face and device-to-device[1]

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Abstract

We present an analysis of mobile face-to-face meeting support systems that reveal the consequences duration has for interaction through and with this technology in public places. Particularly we argue that there are privacy issues at stake. We base our arguments on empirical research concerning public interaction and disclosure of personal information there, seeing that face-to-face support systems add something to the social practice already occurring rather than replacing such altogether. But there is also a human-computer interaction issue. Handling face-to-face meeting support in public places puts demands on accommodating other activities already going on there, such as walking and driving. Our analysis in these variables yield four genres of mobile face-to-face meeting support systems i.e. exposed, insisted, hinted and cloaked. We argue that the genre of cloaked support systems seems most appropriate for sustained meetings weighing privacy and handling. Similarly, the genres of hinted support systems acknowledge privacy and handling of brief meetings.

Introduction

In the research domains of Human-Computer Interaction, Computer Supported Work, and Ubiquitous Computing the topic of mobile face-to-face meeting support systems appear. This subject concerns devising services that encourages or draws on meetings among people whenever and wherever they meet. In recent years mobile face-to-face meeting support has been suggested for unacquainted people meeting in public places such as cafés, on the roads, and in conferences etc. These services cover a wide variety of aims, e.g. sharing of personal information, enable multi-player gaming or music listening in such places. Furthermore they are consequently designed for various mobile settings, and affords in various degrees to be used when simultaneously doing something else. In some cases the other thing is relaxing in a café, in others it is driving around, or visiting conferences etc. We argue here that face-to-face meeting support is essentially designed with attention to a particular duration of the meeting. Furthermore, this duration have consequences for disclosure of personal information and the human-computer interaction with the face-to-face meeting support.

The context of traffic-encounters i.e. face-to-face meetings among driver on public roads constitute a particular setting where such duration matters much. Face-to-face meeting support for this context, such as Hocman (Esbjörnsson et al, 2004), Sound Pryer (Östergren and Juhlin, 2005a), Road Talk (Östergren and Juhlin, 2005b) draw on, and

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cater for people driving. Although not totally separable driving includes both coordinating with fellow road-users, which is a scant, visually oriented, form of social interaction, and maneuvering, referring to the bodily actions for steering and advancing the car. These prototypes distinguish participants taking inspiration from the existing practice of coordination, for instance showing the shape and color of the car they are in. At same time they carefully designed to not strain maneuvering. Consequently, these prototypes portray dealing with duration of a meeting in a particular context. They disclose personal information about the participants and they do so in way they can be apprehended and acted upon in brief meetings. But their design acknowledge that something else is going on – that the participant is also maneuvering.

Generalizing from this research we argue the *duration* is important for meetings public. We uncover how they are conducted and also guide design of face-to-face meeting support systems. We provide a break-down that reveal design principles of existing meeting support based on the duration of the meetings that uncover which social situations are suitable for the different applications. We base our analysis on a wide range of examples of mobile face-to-face meeting support. Hence, this analysis gives insight into trade-offs a designer has to deal with for and targeting and accommodating a particular social context appropriately. The duration of meetings is important for how the participants balance disclosure of their personal information, also commonly referred to as privacy. A sustained meeting allows for presentation of more information than a brief encounter. It allows the participants to take more or longer turns of interchanges, and it also makes it easier to interfold social interaction with other tasks. However, a longer meeting also affords a participant either to be put to a prolonged and embarrassing "trial" and to be convinced to give up such information that the future non-recognition is lost. Thus, a longer meeting makes a participant more reluctant to give away personal information, than a quick interaction. Furthermore, the duration of the meeting is important for the engagement with the meeting support given that participants often also are involved in other co-occurring also demand their attention.

Based on this view of how people manage private and public information in meetings and how demanding in terms of attention the interaction with the device is, we suggest four genres of face-to-face meeting support systems. We label these genres exposed, insisted, hinted, and cloaked and discuss how they fit with meetings of various lengths. In terms of handling all these genres are support sustained meetings. However, when it comes to personal disclosure all but cloaked meeting support systems are ill-suited. Exposed meeting support seems to require revealing an inappropriate amount of personal information, which would open up for focused interaction and participants risk loosing non-recognition. Similarly insisted meeting support suffers also from giving up too much personal information. Hinted support gives little personal information, but the duration of meeting gives plenty of opportunity to initiate focused interaction nevertheless. Cloaked meeting support could work in terms of person disclosure as the personal information provided is very thinned out and therefore preserving non-recognition. On the other hand, cloaked and exposed are ill-suited for brief meetings as they require much handling. Automated insisted and hinted face-to-face meeting support systems can fit in brief meetings. But in terms of addressing, use of insisted meeting support, participants could loose non-recognition, whereas in hinted this is probably preserved.

Related Work

Privacy is a recurring topic within the fields of Human-Computer Interaction (HCI). Especially central applications within the fields of Computer Supported Cooperative Work (CSCW) and Ubiquitous computing (Ubicomp) are considered having inherent privacy connotations. Consequently, there have been many suggestions within these research domains for addressing privacy. We divide these efforts in two genres. The first concerns particular techniques to counter privacy issues in individual systems. The second genre is about general schemes, often borrowing from other research disciplines e.g. social psychology (Palen and Dourish, 2003), economics (Jiang et al, 2003), and law (Iachello and Abowd, 2005) to explain and address privacy issues in system design. In this rich body of work that of Palen and Dourish most closely resembles the ambition of this thesis. They apply social psychologist Irwing Altman's theory of privacy management in face-to-face meetings to system design.

In CSCW various media spaces have been proposed for supporting cooperation between remote work sites (Belotti and Selen, 1993; Boyle et al, 2000). In media spaces video and audio streams are shared among these for creating a sensation of co-location. Although cameras and microphones are required for achieving this end, they also contribute to a potential threat to personal privacy. Users feel uncomfortable with not being sure of who is watching at the other end and for what purpose.

In Ubicomp researchers are working on having computers and computation embedded everywhere reacting pro-actively on behalf users. But this also gives rise to privacy implications. For example, location-dependent systems constitute a classic case of such issues (See for example Langheinrich, 2001 and Consolvo et al, 2005). Today we are surrounded by contextual information e.g. name-tags, post-its and road signs. They are attached to someone, something or somewhere, that give that object and the information attached to it additional meaning. In the future, location-dependent systems could offer such relation between a certain context and digital information. Yet any scheme for achieving this would need to monitor the location of users. The question is, are users comfortable with always disclosing their exact whereabouts?

The efforts of addressing privacy in these research domains could be divided in two genres. The first concerns particular techniques to counter privacy issues in individual systems. A few examples of such are feedback and control in media spaces (Belotti and Sellen, 1993); video filters in media spaces (Hudson and Smith, 1996; Boyle et al, 2000); scrambling in audio-based awareness applications (Hudson and Smith, 1996); context-aware adaptation of input to media spaces (Neustaedter and Greenberg, 2003); and extensive personal information disclosure configuration (Lederar et al, 2004; Patil and Lai, 2005). The virtue of this research is they demonstrate individual cases dealing with some particular privacy concern. The drawback is the lessons learned are hard to generalize and particularly apply to mobile face-to-face meeting support.

The second genre tries to formulate general schemes and strategies to address privacy issues in system design. These strategies are often informed by other research disciplines such as social psychology (Palen and Dourish, 2003), economics (Jiang et al, 2003), and law (Iachello and Abowd, 2005). In this genre the work of Palen and Dourish is most close to this work. Although they consider distributed systems such as "video conferencing, shared calendar management, and instant messaging communications (Palen and Dourish, 2003)" they discuss privacy in systems basing their arguments on

social psychology. With insight in Irwin Altman's examination of face-to-face meetings they critique such systems since "… our ability to rely on these same physical, psychological and social mechanisms for regulating privacy is changed and often reduced (Palen and Dourish, 2003)." According to them privacy should be "… understood to be under continuous negotiation and management, with the boundary that distinguishes privacy and publicity refined according to circumstance (Palen and Dourish, 2003)." To maintain this boundary, they argue that disclosure of personal information or whereabouts is often required. The problem in these systems, they argue, is that users may not have control over their identity definition and the boundary making process.

Palen and Dourish's examiniation of privacy demonstrates the second genre. They apply social science to system design in a general sense, but unfortunately the schemes they derive are simultaneously quite vague. Besides focusing on distributed systems rather than face-to-face meeting support we examine here, they are not equally well-connected to actual design cases. Rather the models tend also to be justified with arguments of anecdotal character. For example Palen and Dourish states "… we explore various cases drawn from our own observations as well as those of our colleagues; some of these cases have been discussed in research publications, while others are *informal experiences* reflected upon here for the first time (Palen and Dourish, 2003, our emphasis)." This paper aims to give a profound theoretical explanation, relying on sociologist Erving Goffman's empirical research, for privacy connotations in an entire genre of well-documented research applications i.e. mobile face-to-face meeting support.

Mobile face-to-face meeting support systems

Mobile face-to-face meeting support systems is an emergent class of information technology for encouraging and reinforcing spontaneous meetings of people, which often require personal devices aiming for multi-user situations. The purpose is to increase social interaction by adding a new electronic resource through which people can also communicate. Historically, face-to-face meeting support is inspired by the understanding of office work such as planning, coordination, brain-storming occurs in informal meetings (Kraut and Egido, 1988). For example, informal communication and report production in scientific environments recede exponentially as the geographically distance between partners increase. Kraut and Egido argue that technologies which "substitute for, and even augment, physical proximity are likely to yield great benefits (1988)." The scope of mobile face to face meeting support has been extended beyond work activities to fun and pleasure and then also including situations where unacquainted persons interact.

We are here concerned with mobile meeting support used in public settings between unacquainted people. This is a highly relevant seeing that several meeting support are argued to be supportive of such interaction. There are several examples. MemeTags is designed for conferences "… where people united by a common interest meet to share ideas, renew friendships, and forge new collaborations (Borovoy et al, 1998a)." Jabberwocky (Paulos and Goodman, 2004) is designed to support interaction amongst "familiar strangers" defined as "… a border zone between people we know and the completely unknown strangers we encounter once and never see again (2004)." Far Cry (Tennent et al, 2005) is designed for spontaneous meeting among people including such familiar strangers. Folkmusic addresses "smart mobs" consisting of "… people who are able to act in concert even if they don't know each other ... (Wiberg, 2004)" The Proem

platform is built to support interaction between people "…whom we never met before… Such an encounter with another person is a chance for striking up a conversation and for exchanging information (Kortuem et al, 1999)." Hocman is designed for motor bikers that socialize on the vast public roads and "… appreciate interacting with … unacquainted bikers … (Esbjörnsson et al, 2003). Sound Pryer draws on "… the enjoyment that we believe drivers sometimes derive from looking around and forming impressions of nearby road users and their vehicles (Östergren and Juhlin, 2005)." TunaA is among else targeted to anonymous people such as commuters to create "new social links (Bassoli et al, 2003).

We particularly recognize that mobile face-to-face meeting support systems add something to the social practice already occurring rather than replacing them altogether. Hence, the interaction through this technology has strong links to how that interaction is currently done without their support. Thus a critical issue in these systems depends on the way they are embedded into the ongoing face to face interaction. In other words, the interaction that will be mediated through the technology, but also occur in parallel to the interaction mediated visually or aurally as people are in each others' proximity.

Revealing identity in public

The first generation of meeting support was designed for families, friends and colleagues, This design approach seem obvious given that these groups constantly interact for various purposes. But the extension of the design approach to support public interaction among anonymous people needs more than an implicit grounding in social practices. In mobile face-to-face meeting support systems, personal information is shown, entered or selected by the user to initiate communication with some other user through them. Such information is common in any distributed systems also where people interact over distances, such as blogs, message boards and chats of the Internet. Most commonly nicknames, symbols, and addresses are used to distinguish users. But personal information conveyed within the application could also extensively describe the self, in terms of curriculum vitae, musical preferences, topics of interests etc. Is such disclosure of personal identification and information appropriate in public interaction when people are being close to each other? Here the issue of privacy seems more critical. However, we argue that people in public do interact for various persons even with people they have never seen before, which underscores the opportunities to further enrich such interaction.

People who are visible for each other in public interact in various ways and for various purposes. For example, they interact to negotiate right of way in order to avoid collisions as they move in and out of each others proximity. They interact to accomplish their business and they simply look at each other, which is also a form of interaction. Interaction in public was profoundly studied by sociologist Ervin Goffman. We will give a brief summary of the main points of *Relations in Public* (Goffman, 1963). This book deals with what types of interaction occurs there and particularly how people balance what they communicate and what they hold for themselves in these meetings. To start with, Goffman makes a distinction between unfocused interaction and focused interaction (Goffman, 1963). Unfocused interaction refers to "the kind of communication that occurs when one gleans information about another person present by glancing at him (Goffman, 1963, p. 24)." People orient themselves for such glances by e.g. arranging their clothes,

putting on make-up, and preparing hair-dos, etc. They also display performances such as sitting in a special way or behave in a certain manner. Goffman argues that:

> "...while these signs seem ill suited for extended discursive messages, in contrast to speech, they do seem well designed to convey information about the actors´s social attributes and about his conception of himself, of the others present and of the setting (Goffman, 1963, p. 34)."

Focused interaction concerns people gathering "… close together and openly cooperate to sustain a single focus of attention, typically by taking turns at talking (Goffman, 1963, p. 24)." Participants in such meetings take notice of, and orient themselves, to each other. The simplest example of focused interaction in public is civil inattention i.e. the practice of looking toward an oncoming person, meet that person's gaze, and then immediately look away while approaching, as if "dimming the lights (Goffman, 1963, p. 84)." The purpose is to first examine the other person, but then to look away to show that he or she is not recognized in any way.

As a general rule, face-to-face meetings seldom go beyond civil inattention: "... mutual glances ordinarily must be withheld if an encounter is to be avoided, for eye contact opens one up for face engagement (Goffman, 1963, p. 95)." According to Goffman people suspect extended focused interaction could lead to unwanted consequences. For example, participants feel they can be lured into a situation where they are attacked or physically assaulted. Extended interaction can create opportunity for reception of pleadings; commands; threats; insults or false information. It could also create unwanted bonds with mutual obligations (Goffman, 1963, p. 105) and participants could loose non-recognition in the future (Goffman, 1963, p. 139).

Still, Goffman argues, extended focused interaction does occur in public places, but only under specific circumstances (Goffman, 1963, p. 125). First, it can occur in daily business for example when speaking to salesperson. Second, extended interaction is prevalent when for instance talking to policemen or priests, who are public figures. Third, it occurs when people clearly are out of role e.g. when wearing costumes. Fourth, people engage in more extended communication if someone obviously needs help.

Another flavor of focused interaction in public occurs in so called "remedial interchanges". The co-mingling in public life draws upon sets of shared norms. Remedial interchanges come about when conventions and rules are disobeyed. Breaking a rule for unfocussed interaction may lead to focused interaction. The reason for this the participants are anonymous, therefore there is no way of getting back and settle the issue. It has to be done at the spot:

> "The individual therefore must not only provide clarifying information, but when he cannot convince others of his innocence he must also be prepared to do penance and provide reparations on the spot in exchange for being back into good graces a moment later. Thus, social situations are not to be seen as places where rules are obeyed or secretely broken, but rather as settings for racing through versions in miniature of the entire juridicial process (Goffman, 1963, p. 137)."

Hence, in general, people interact in public but the meetings are not as rich as face-to-face interaction between familiar people such as friends, families and colleagues. The balance between what people disclose and what they hold for themselves is different from a meeting to another depending very much the person met and the circumstance. In the following, we argue that the temporality is an important, but somewhat neglected, parameter when people balance what they hold as private and what they make public.

Privacy and the temporality of meetings

The temporality of a meeting, that is how it develops in space and time, is of importance for the interaction between the participants according to the sociologist David Sudnow. He aruges the interaction occurring when a person wants to avoid an acquainted person in a public is tied to the setting. To avoid opening up for conversation, a person can engage in activities which makes it believable that he or she is not avoiding the other person. These activities must appear natural in that situation and during the period when the acquaintance might look in his direction:

> "We are in a position to assess, judging from his distance from us when we first see him and his likely pace..., when he will likely be no longer watching us. We may perhaps also feel comfortable with an inference about, when, given some starting point in his approaching path, he may first see us (Sudnow, 1972, p. 266)."

In this particular case non-recognition of that acquaintance is achieved by organizing the glances and the activities are in time and space, creating a beneficial social situation. Particularly noteworthy is that, although the subject in this quote acts with the temporal aspects of the meeting in mind, he does not have the facts in his hand e.g. whether it will be a brief or a long meeting. Still, this person must make out some understanding of such temporal parameters as it unfolds: "The obvious usability of the glance for "making out" necessarily grasped features from ongoing courses of action, attests member´s ability to "short circuit" retrospective-prospective observation and inference (Sudnow, 1972, p. 262)."

We learn from Sudnow that making out temporality in meetings are not only about interpreting the participant's physical movements in and out of the meeting. It is also about interpreting the "internal time structure of the activities" in a broader sense. For example, making out what the other person is doing and his or her intentions with that: is he or she going to stop or turn back etc. Thus, on one hand, the temporalities of meetings are governed by the time the participants are visible for each other. On the other hand, people also orient themselves to how they predict the duration of the interaction that the meeting gives rise to. That duration is something that the participants interpret not after the meeting is concluded, but during the meeting as it unfolds. Thus, the participants interpret whether the other party will be in sight for a while. This includes interpreting their movements and intentions as well as their possibilities to change direction to actively sustain the meetings.

We stress that the temporality off the meeting is an important aspect when participants decide what to keep for themselves and what to reveal. The temporality of meetings is the not at the focus of Goffman's research, yet he includes some arguments that points to its significance. For example:

> "Seatmates, while likely to be strangers...are also fixed for a long period of time, so that conversation, once begun, may be difficult thereafter either to close or to sustain. In such cases, a strategy is to "thin out" the encounter by keeping it impersonal and by declining to exchange identifying names, thus guaranteeing that some kind of nonrecognition will be possible in the future (Goffman, 1963, p. 139)."

Furthermore, the duration has consequences in case the participants are requested to remedy interaction. Goffman exemplifies with a clumsy pedestrian who offend someone, for instance by bumping into him or her. A short meeting is better for this offender because he or she has to endure less embarrassment and "hate stares", than a in a longer meeting. In a brief meeting the offender can quickly get out of the gaze of the offended.

Goffman compares the clumsy pedestrian offender with a clumsy car driver. In comparison the driver who has crashed into another car has to endure more embarrassment, because the meeting likely lasts longer.

Thus we argue that there exists something of a privacy-duration paradox. A longer meeting is better since it affords more turns of interchanges. But a longer meeting also affords a participant either to be put to a prolonged and embarrassing "trial" and to be convinced to give up such information that the future non-recognition is lost. A short meeting affords less of turns of interchanges and depth in information. But it is less risky to be set on trial for the information communicated, and less risk to be lured into revealing too much.

Human-computer handling

The human-computer interaction in face-to-face meeting support concerns the actions the user must take to feed the meeting support with adequate and meaningful input that it requires. This interaction follows a certain path towards some goal. There is some ambition built into the meeting support. What this ambition is depends on the application, e.g. sharing music, providing awareness of others, multi-player gaming etc. to name a few. To complete this goal the meeting support requires some actions on behalf of the user. To share music the user may need to specify which file to download; to learn about presence of others the user needs pick up and look at the device; and to play a game the user may need to push buttons and watch over the display etc.

A key feature in face-to-face meeting support systems concerns what they demand in terms of *handling*. Handling is here referred to as the human-computer interaction which the face-to-face meeting support systems require for successfully completing one of possibly several missions. Attention is a particular scarce human resource that often must be divided among several activities. Engaging in the meeting and other performing side-activities has to be shared within the duration of the meeting. And when people engage in face-to-face interaction in public settings there are also other important activities going on. They look at where they are walking or driving. They read books or journals, do window shopping, look at their bags or arrange their clothes. Often, face to face meetings often occur often in conjunction with other activities and the participants divide their attention between the meetings and other activities. In an ethnographic study, Laurier and Philo (1998), has specifically studied multitasking of office work and driving. The act of focusing on surrounding drivers to negotiate right-of-way is integrated with office work on moment-by-moment coordination in a contingent situation. It is combined in the same manner as we coordinate e.g. looking through windscreen and the rear mirror:

> "There are legitimate involvements of driving that could cause an accident but are dealt with as part of the commonsense grounds of driving: looking for too long at the speedo, fuel gauge or rear view mirror. Learner drivers have to learn how to divide their attention appropriately between monitoring speed ahead, the rear view mirror and the instrument panel." (Laurier and Philo, 1998).

From the point of view of this paper, we recognize that face-to-face interaction occurs in a context where other activities are going on. The way that this division of the focus of attention occurs is of importance for the time available for social interaction, as well as the design of support for it. This is similar to Stephen Brewster who argues:

> "…users are performing tasks whilst walking or driving, they cannot devote all their visual attention to the mobile device. Visual attention resources must remain with the main task for safety. It is therefore hard to design a visual interface that can work under these circumstances (Brewster, 2002, p. 191)."

Consequently, if the focus is on handling the face-to-face meeting support, it requires a meeting of a minimal duration. An application that requires little handling can accomplish its mission in brief meetings. And oppositely, a lot of handling cannot be fitted in meetings below certain duration. Furthermore there is a relation between handling and the nature of mobility. A lot of handling requires not only a long meeting, but likely it is most conveniently performed at full stop and perhaps even sitting down.

Mapping face-to-face meeting support to disclosure and handling

The combination of the personal information disclosure and the human-computer handling yield a design space in which we can order the principal applications we find in the research literature. In Figure 1 we present a diagram where the applications are ordered according to their richness in terms of personal information disclosure and the amount of handling they require. We will give a clockwise tour of this taxonomy starting at the top-right corner.
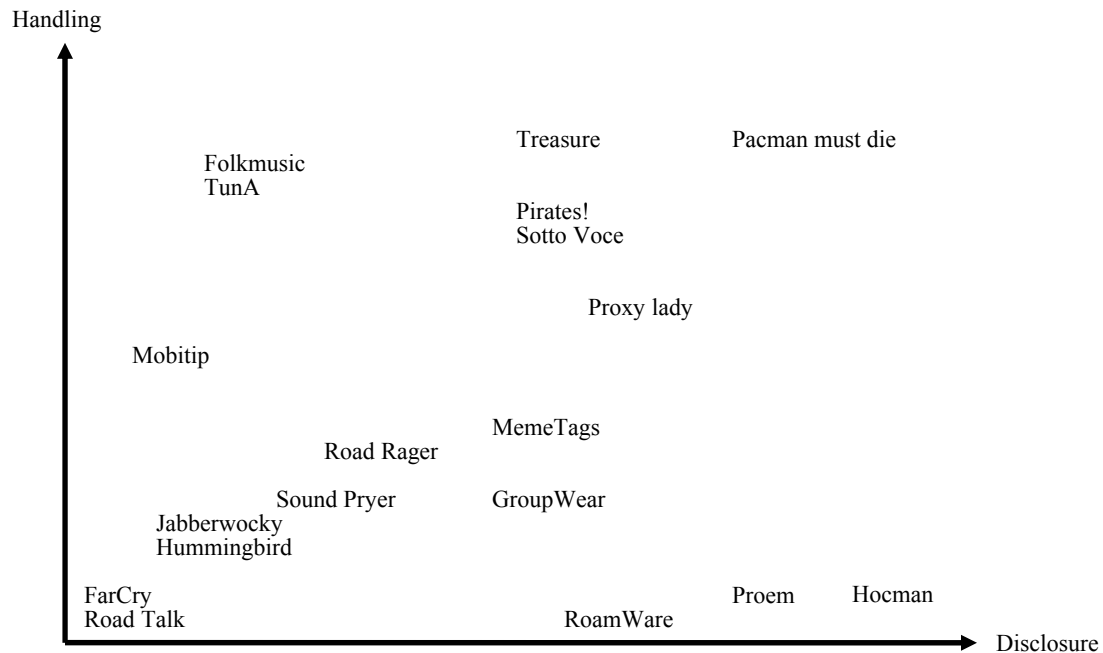

Figure 1. A classification of face-to-face meeting support according to personal information disclosure and handling.

Towards the top-right corner we find applications that demand extensive handling yet also provide rich addressing. In these applications it is not necessarily so that virtual information is required or abundant but they are highly dependent on rich real information. These applications encourages seeing the other participant in order to give a full experience. But that does not mean that they break down if this is not the case – but the experience could very well be awfully confusing. Nevertheless, these applications require an extensive amount of handling. They are exclusively for situations when you walk about and there is plenty of opportunity to stop or sit down and concentrate.

At the extreme we find the PDA based game "Pacman must die" (Sanneblad and Holmquist, 2004). Here the participants have to look at each other's displays to complete the game. This requires knowing what real person corresponds to which virtual character and game device. But also making sure being close to the other participants and seeing the characters as they appear on other devices. Hence addressing in terms of real information is required to complete the game. We also find 'Treasure,' a PDA-based game drawing on GPS positioning and wireless LAN connectivity and connectivity gaps and breaks of these technologies (Barkhuus et al, 2005). The objective for players of this game is to collect coins. These virtual coins spread out in an outdoors environment and players pick them up by walking close to their physical locations. While collecting coins players must look out for virtual mines that scatter coins. Players can secure points by uploading the coins within wireless connectivity. Within network coverage players may also steal other close-by player's coins that are not yet uploaded and also counter such attempts. 'Pirates!' is a PDA-based game in this genre, which let the participants dual each other when the move within some proximity of each other (Björk et al, 2001). The battle is portrayed as gun fights between pirate ships and displayed on the users display. The users that engage in battles have identical views, so in contrast to the 'Packman must die' game it is not mandatory to look at somebody else's display. Sotto Voce is a museum tour-guide that allows users pair wise experience multimedia items about a museum exhibition (Aioki et al, 2002). Sotto Voce allows one user to eavesdrop what the other is currently listening to and in that way share experiences. Finally, Proxy Lady is a tool to bridge e-mail exchanges between users to them meetings spontaneously in hallways, cafeterias etc. of offices (Dahlberg et al, 2002). When users coincide the ProxyLady reminds them of and allow examining their common e-mails on foot.

Moving down to the lower-right corner we find applications that supply rich means of addressing, but require very little handling. Typically these applications play a subordinate role within the meeting. On the other hand they see to that extensive virtual information is shared among the participants. The purpose is to allow appreciating it at some future point of time after the meeting has ended. The handling here serves to at most provide awareness of co-located participants. Consequently these prototypes put little requirements on the duration of the meeting. This also supports people meeting in traffic.

The most fitting example is the PDA application Hocman for motorbikers (Esbjörnsson et al, 2004). Hocman only provides scant awareness of other bikers during their encounters. It plays a brief chirp to denote there are other bikers around. However during the meeting Hocman also distributes information about the biker in the form of personal web pages to be appreciated at some later point in time. These web pages contains rich virtual information about the bikers in the form of for-sale advertisements, contact information, special interests etc.

But we also find meeting support for people that meet on-foot. Proem is an application that besides awareness allows exchange of profiles when users meet (Kortuem et al, 1999). A profile consists of personal preferences, interests, general background etc. RoamWare logs all meetings that occur among its users (Wiberg, 2001). Through a wide range of desktop applications this log may later be examined. The meeting information it contains is then associated to many other kinds of contact information, such as e-mail and meeting agenda.

At the lower-left corner we find face-to-face meeting support that does not provide addressing or require much handling. Common for them all is they hint co-presence and whereabouts of other users. Moving towards the extreme we find for instance applications that specialize in providing awareness of co-located participants. Hummingbird is a typical example of such (Holmquist et al, 1999). It plays a humming sound whenever and as long as the devices are within some distance to each other. This distance is governed by the propagation and reach of wireless transmitters, which does not necessarily correspond viewing range. The Jabberwocky device silently detects and records all unique identities of the other Jabberwocky devices it encounters (Paulos and Goodman, 2004). The log of previous encounters is continuously analyzed for patterns. The number of meetings and the duration of them tell the degree of familiarity. These patterns are displayed through flashing diodes of various colors.

But also found here are concepts that demand more elaborated handling. Road Rager is a mobile multi-user game for kids in the backseat (Brunnberg, 2004). The kids may cast spells at each other in encounters. They do this by waving a 'magical' wand in the actual direction of the opponent. Clues to where the opponent is located are given by a collection of diodes. They are placed in a circle and if the opponent is to the left then the left-most diode is lit. Sound Pryer is the collaborative car stereo (Östergren, 2004). A user can besides hearing his or her music also tap into the music played on other Sound Pryers close-by. Besides hearing the music Sound Pryer gives an impression of the car where it is played. A stylized shape and the colour of it hint the source of music.

Yet at the point where the axis meet we find cases that draw upon meetings, for instance, to distribute data, but make the fact of them taking place completely transparent for the participants. This class of applications is supported by meetings among participants, instead of actually supporting meetings on behalf of the participants. Hence the cases at the very extreme do not contribute much to this analysis. Nevertheless, the FarCry framework (Tennent et al, 2005) and Road Talk (Östergren and Juhlin, 2005) are typical example of such independent and transparent data synchronization in encounters.

Towards the top-left corner we find the applications that require much handling, but rely or demand little addressing. Typically the focus of these applications is hauling some content among the participants. They are less about socializing either through or over the meeting support. The means for addressing is often designed to encourage cloaking the real identity of the participants and they solemnly rely on e.g. nicknames, icons etc. A typical example is Folkmusic which allows co-located participants share music files (Wiberg, 2004). The focus is on the musical experience rather than socializing. The application provides little virtual or real information about the participants.

TunA is another mobile music sharing application which is similar to Folkmusic with respect to scope, addressing and handling (Bassoli et al, 2003). It too essentially allows sharing music among co-located users. MobiTip, on the other hand is an application that allows sharing person recommendations (Rudström et al, 2005). The recommendations concern places that are found within a mall, such as stores, cafeterias etc. It applies social filtering to order the recommendations and provide a social trace tailored also matching the user's preferences.

Finally at the centre of the diagram we find the cases which provide addressing opportunities and require some handling. The trade-offs in terms of addressing and handling is more delicate than in the corners, but roughly these systems are designed to

support a literal interpretation of face-to-face situations. They provide some support while the participants are practically looking at each other. Hence the addressing in terms of real information runs high, but the virtual is of lesser importance. Here we find examples that are designed to stimulate conversations on-foot. In these particular examples handling is minimal or not required at all.

The most fitting example is MemeTags which let's participant of a face-to-face meeting share short text messages (Borovoy et al, 1998a). The users wear badges that contain a small display. When users meet pair wise and face-to-face the badges show a witty text message that the other badge does not carry. If one participant like what is displayed on the other user's badge, he or she pushes a button to acquire it. That message is then incorporated to the collection of messages on the device and later shown in other meetings. GroupWare is somewhat similar to the previous example (Borovoy et al, 1998b). The idea here is also to augment the name tags worn at conferences etc. The GroupWare tag displays five diodes that each represents an answer to a yes-or-no question. The bearer of the name tag programs the tag personally. When meeting with others the tag indicates which question the users had as common answer to by lighting up the diodes.

Exposed, insisted, hinted, and cloaked interaction

Revisiting the taxonomy we can now formulate four genres of mobile face-to-face meeting support system design. These gangers are motivated by the face-to-face meeting support reviewed above and displayed in figure 2. We refer these genres as *exposed*, *insisted*, *hinted*, and *cloaked* design.
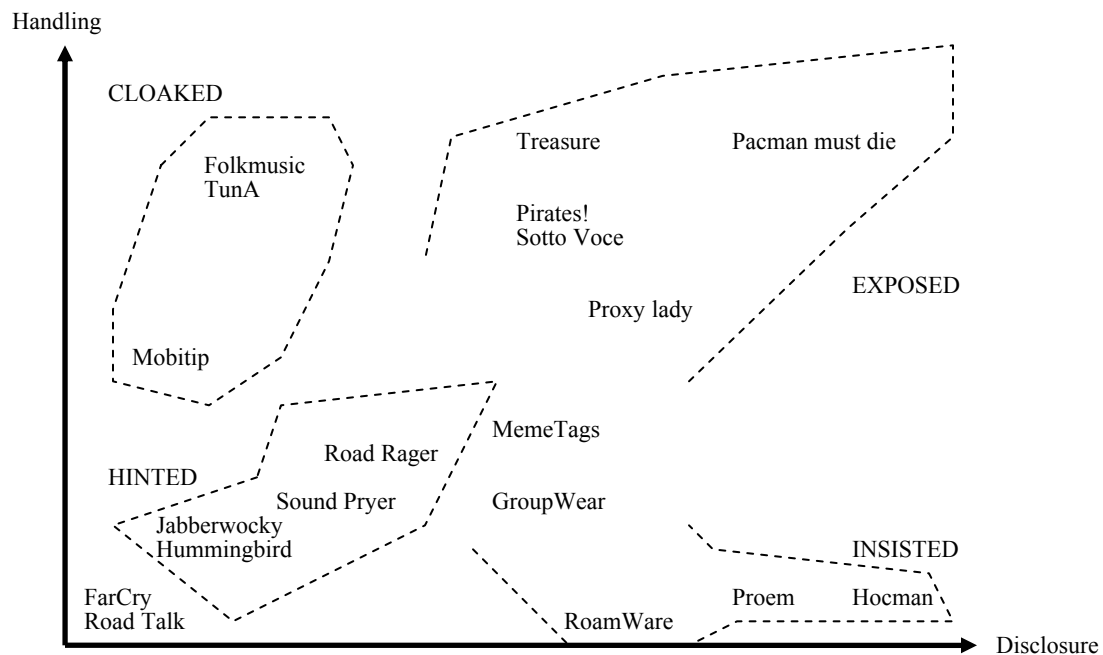

Figure 2. Exposed, insisted, hinted and cloaked face-to-face meeting support.

Exposed face-to-face meeting support requires a lot of handling and addressing is often rich in addressing. Exposed meeting supports strive to encourage extensive engagement

at close proximity. But to accomplish this they require that participants and their whereabouts are known. The extreme example is "Pacman must die" which requires participants to be right next to each other in order to finish the game (Sanneblad and Holmquist, 2004).

Insisted face-to-face meeting support demand little attention within the meeting, but compensate by distributing rich virtual information of the participants. This information is provided to re-establish some form of contact possibly long after the meeting has ended. The most obvious example of insisted design is Hocman, which apart from giving an audio cue, exchanges web pages within the meeting (Esbjörnsson et al, 2004). The pages may contain extensive information of the participants, not only text, but pictures, audio etc. In a sense the information is forced upon the participants.

Hinted face-to-face meeting support gives ambiguous information about the participants of a meeting. Typically they subtly indicate the other users. A part of experience use is to figure out which or where the users are. A good example of hinted meeting support is Sound Pryer, which discloses an iconic picture and colour of the car where the music is playing in (Östergren, 2004). A user must invest some effort looking out and search the environment to find the car.

Cloaked meeting support allows the participants to more or less keep the identity secret. Yet they require quite a lot of handling. These systems examined here are oriented towards sharing some content. For instance, the Folkmusic prototype relies solemnly on nicknames to distinguish users and proximity is only required in a rough sense. Users need to only be within range of each others wireless transmitters to download or share music, but that does not say they are necessarily face-to-face nor within viewing range (Wiberg, 2004).

Discussion

With these genres of face-to-face meeting support apparent we are ready to discuss how they coerce with the duration of public encounters. In order to manage the discussion of duration in face-to-face meetings in public we present two extreme general categories thereof: *sustained* and *brief* meetings. First, *sustained* meetings are meetings perceived as occurring during tenth of minutes and hours. Examples thereof are people sitting close at cafes or side by side in a train compartment. Such meetings are typically so long that the participants are normally sitting. Second, in *brief* meetings the participants interact during a couple of seconds. This category includes people that very briefly meet in cars traveling in opposite directions. Such short duration imply that the participants are moving rather fast. Hasty movement makes the category more predictable. There is less opportunity to prolong the meeting and change the duration by turning around and catch up.

The categories of brief and sustained should not be understood as descriptions of all meetings in these contexts. There are obviously meetings in cafés that are shorter than meetings in traffic. But this formalization of generalized meetings will work as a resource when thinking about the importance of duration and temporality for public face-to-face meeting support. The duration of meetings relates to how people balances privacy.

Fitting design approaches to sustained meetings

A sustained meeting, as we define it, occurs when people are sitting near each other at a café and expect each other to be their for a while. The design for handling of a mobile

device is not an issue for any of the design approaches as discussed above. There is plenty of time to divide the attention between face to face meetings as well as interacting with mobile devices. More interestingly, the approaches differ in the way they fit with how people could be expected to balance their informational preserve between private and public.

Exposed interaction seem ill suited since it would uncover very much of private information to unaquainted people in the proximity. There is thus plenty of time for the people in the cafe to open up for focused interaction even based on deleted non recognition in the future. They can address the person, who bare herselves electronically based on that particular information, and even call into question that particular information e.g. as bad taste. It is possible to think of exceptional situation as discussed by Goffman, when people open up for focussed interaction when they meet people in line of everyday business; priests; police or persons who are out of role. Exposed interaction would then be a possible approach. Applications such as games would perhaps be suitable for people who act like women on a hen night, even though not with priests. In the end, this design approach seems not fit that well with social practice. *Insisted* interaction approach make the handling of the interaction even better in this situation, but suffer from the same type of uncovering as exposed interaction, and thus fits equally bad with the social situation. *Hinted* interaction is more meagre as to what is revealed of private information. This information is not enough to loose non recognition in the future but give away more of you than what's now available through unfocused interaction. Here it is more difficult to decide whether this would be appropriate. Would a person reveal its music taste in a cafee by letting people around herselves first let anyone listen into the music played as well as revealing where the music comes from e.g. by revealing the direction to where she is sitting? We suggest that this would not be appropriate in that sistuation since it again could open up for focussed interaction.

However, we argue that *cloaked* interaction could work. In cloaked interaction the information that is presented is so "thinned out" that it both preserves "non recognition" in the future and in the local situation. People in the café can thus enjoy some of the information, but have to struggle hard to understand which person which provides it. The obvious example is Atuna. The down side of this design strategy that it misses out on drawing on the social context in the service. It will be more of a music listening service than a service which provides opportunities to listen into other people and then also being able to think about their music taste. Then, the servie is comparable to how anonymous people interact with each other on file sharing services on the internet. These services provide possibility to aquire information, but it is stripped of resources to think about its context of use. Still, cloaked interaction could be an alternative to wide area networks which are not always available and often are quite expensive to use.

Fitting design approaches to brief meetings

Handling is more of an issue in brief meetings where the focus of attention has to favour the coordination of the vehicle units. Thus both the exposed design approach and the cloaked design approach are inappropriate since they depend on the users focussing mostly on the interaction with the computer. But both the insisted approach and the hinted appraoch provide means of handling which make the demand on handling

appropriate even for brief meetings in traffic. Then the issue is how these approaches fit with requests for balance between public and provide.

Here we argue that *hinted* interaction would be suitable for brief face-to-face meeting support. The information conveyed in a meeting will not make the participant recognisable in future encounters. Typically, it provides clues as to who provide some information and that information is not either of any depths. When people disappear out of the meeting there will be no more interaction, and it is so brief that the participants will find it very difficult to prolong interaction e.g. to open up for remedial interchanges. Sound pryer is an example where only info to identify who in the surrounding is sending, as well as only access to the music that is played in that particular moment is revealed. Thus, the design approach fit wit social practice. It only provide for augmentation of the recurring unfocused interaction, but that augmentation will likely not lead to increased focussed interaction due to the temporal structure of the meeting. Finally, we suggest that *insisted* interaction would be less appropriate for brief meetings. Since in depth information of the participants will be revealed non recognition in the future might be lost.

Conclusion

In conclusion support for public meetings is an idea with lots of limitations. The boundaries for its use are first of all how the systems cope with the need of the participants to share their attention in mobile situations. Secondly, and possibly more important, we suggest that such services do not sit nicely with the way we are used to balance our need for privacy with what we make public. Here, if both these aspects we suggest that there exists a duration paradox. A sustained meeting allows for presentation of more information than a brief encounter. It allows the participants to take more or longer turns of interchanges, and it also makes it easier to interfold social interaction with other tasks. However, a longer meeting also affords a participant either to be put to a prolonged and embarrassing "trial" and to be convinced to give up such information that the future non-recognition is lost. Thus, a longer meeting makes a participant more reluctant to give away personal information, than a quick interaction. It follows that only one of the discussed design approaches fit with each form of meeting. Hinted interaction fits well with brief meetings, and cloaked interaction seems suitable for more prolonged interaction.

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