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Using IT to Make Place in Space: Evaluating Mobile Technology Support for Sport Spectators

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USING IT TO MAKE PLACE IN SPACE: EVALUATING MOBILE TECHNOLOGY SUPPORT FOR SPORT SPECTATORS

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Abstract

This paper reports results from two field trials of TrottingPal, a mobile system that supports event information management and seamless collaboration between spectators at the trotting track. Each aspect of collaboration within this activity has an important influence on spectator activities at the track and how they are organized. The variety of existing information sources at the track poses not only the challenge to get information, but also to use and interpret that information to decide on how to place bets. These findings have been derived during an ethnographic study. The study, of which the design of TrottingPal is based on, has focused on understanding how spectators organize and co-ordinate their activities and how they exchange relevant event information. This work focuses on two dimensions; (1) the use of TrottingPal within the practices of attending spectators and (2) the usability of the design. The two field trials were focused separately on the two dimensions above. 10 undergraduates were involved in evaluating the design of the system, while 10 experienced spectators participated in the evaluation of its concept and functionality. Conceptual work on the notion of space and place is used as an analytical tool to guide the understanding of technology use by the spectators. The data was analyzed and indicate a change in how spectators go about certain activities while having extended opportunities to access information and other people. Further, findings suggest that the technology introduced extends the notion of place among the users, in terms of enabling a seamless way of information exchange and collaboration.

Keywords: Mobile and wireless collaboration, Mobile web applications, Space and place, User studies, Sporting events.

1 INTRODUCTION

In this paper we focus on field trials of mobile technology support for spectators at the trotting track, namely the TrottingPal system. We are interested in examining its initial value within spectator practices. Based on results from an ethnographically inspired field study, TrottingPal has been designed to support mobility, personalization of information and collaboration between spectators. In the context of the trotting track, relevant and important information is carefully examined in order to place well founded bets. Spectators discuss intensely and collaborate to jointly interpret information about a variety of factors. Research into collaboration supported by information technology (IT) has been frequent in the field of computer supported cooperative work (CSCW), with a main focus on support for different work and business settings (e.g. Belotti and Bly, 1996; Hughes, King, Rodden and Andersen, 1994; Hughes, Randall and Shapiro, 1992) and on collaborative work where people that are distributed in time and space are supported by IT. These studies have mainly focused on understanding work practice (Luff, Hindmarsch and Heath, 2001) and to use findings to inform the design of new technology (Plowman, Rogers and Ramage, 1995). During recent years, research has started to also concern people in non-work related settings, such as public spaces and during leisure time. For example, studies have been conducted on teenager's use of mobile phones (Weilenmann and Larsson, 2001), guide applications for tourists (Grinter, Aoki, Hurst, Szymanski, Thornton, and Woodruff, 2002; Brown, Chalmers, and MacColl, 2003; Cheverst, Davies, Mitchell, Friday, and Efstratiou, 2000; Abowd, Atkeson, Hong, Long, Kooper, and Pinkerton, 1997) and technology support for car-commuters (Åkesson & Nilsson, 2000), to mention a few. This poses the challenge to understand how people communicate and collaborate within contexts away from the workplace.

A rapid development of IT has resulted in that laptop computers and handheld devices increasingly provide wireless communication capabilities. As these features get more and more established much work remains in exploring the interaction and add-on value that take place between mobile users (Buszko, Lee, and Helal, 2001). Luff and Heath (1998) have argued for the need to investigate how mobility is linked to collaboration. In this context, mobility can be viewed as a prerequisite for collaboration at the trotting track, when it comes to personalization of information content and collaboration. It is dependent on where other spectators and sources of information are spatially situated. This stems from that spectators are using their social network, locally at the track, as a means for interpretation of gathered information. Our previous empirical studies (Nilsson & Nuldén, 2003) indicate that this setting includes a variety of mobile activities, such as wandering around different sources of information at the track, and among other spectators that possess valuable knowledge about the participating competitors. Opportunity for collaboration occurs when spectators meet and interact at different locations at the track. Further, with whom information is to be shared, is socially negotiated between individuals and groups. With this background the research question to be elaborated in this paper is as follows: *How can mobile technology serve as a tool and generate value within spectator practices at the trotting track?*

The results are based on observational studies of the system in use during two field trials. The first field trial served to generate feedback about the usability of the design. The second session was aimed to explore the use of TrottingPal within the practices of attending spectators. The findings suggest the following: since TrottingPal provided a seamless access to information, groups used physical spaces for discussions that earlier had been avoided due to limited access to event information. Users reported increased support while being dispersed, facilitated by continuous interaction using TrottingPal. Further, observations of the application in use indicate that TrottingPal faded the boundaries for interaction, i.e. users took less notice of group members joining or temporarily leaving sessions of face-to-face interaction. Moreover, to conduct two separate field trials enabled us to divide matters concerning interaction from functional value and conceptual use within spectator practices, which allowed a more focused data collection.

The remainder of the paper is organized as follows. First, we start with how technology was designed to facilitate mobility, information management and collaboration based on previous work. Second, the system functionality is explained. Next, we describe the research method. Then findings from the field trials are presented, followed by a discussion and analysis. The analysis focuses on spectator mobility, in terms of how spectators treat and make use of space as opportunity for meaningful action (place). Following this, the paper concludes.

2 DESIGN ISSUES AND IMPLICATIONS

The design of TrottingPal and its features is based on previous empirically derived findings. During the fieldwork in 2001, three main characteristics relevant for design were identified, namely *mobility, personalization and collaboration.* These characteristics are to a large extent triggers of spectator practices and action (Nilsson & Nuldén 2003). It provides us with a general understanding of why spectators visit the trotting track, what constitutes their experience, and how they go about their activities at the track[1]:

- Much of the information sources available at the track, and activities, are spatially distributed, leading to extensive spectator *mobility*. There is also diversity in how spectators perceive and make use of different spaces at the track premises.
- Spectators differ in their view about which information sources to rely on; they *personalize* and *manage* their information, which provide input about event-specific conditions. Personalization finds expression in, for instance, the selective manner in which spectators gather relevant information. In addition, each spectator can manage information as they see fit.
- There are many contributing factors at work at the trotting track. For instance, highly momentary, physical conditions, i.e. state of competitors, dampness of the racing track, weather etc. These factors have a strong influence on how the event evolves. Many of these factors are more or less known to the spectators, and are considered important. Spectators discuss and *collaborate* to jointly interpret information about these factors.

Attending the trotting track is a social activity. The experience is the competition itself, but also to socialize and interact with other spectators. The latter is also a prerequisite for spectators to collect relevant information to guide their bets[2]. Much of the information present leaves much room for interpretation, which makes the social network very important. Therefore, spectators spend time discussing the resulting effects of the information as they meet at the track. The culture is heavily permeated by *the person that possess the greater knowledge will place qualified bets and beat the others.* There is diversity when it comes to what is considered valid and reliable information sources amongst spectators, and is under ceaseless change. Below we summarize the main implications for design, concerning mobility, information management and collaboration, derived from previous empirical work.

2.1 Implications for mobility

- The system needs to provide seamless information access to a number of distributed resources and present them in a structured and intelligible way.

The process of gathering information involves a number of information resources in different formats, i.e. TV screens, loudspeakers, announcement boards, which are situated at fixed locations at the track. Thus, the system can provide equal support but with more integration, creating a more legible

[1] In this section a brief background to the characteristics is presented as a background for the design. See Nilsson & Nuldén (2003) for more details about the fieldwork.

[2] The yearly turnover of all betting in Sweden is currently around $4.86 billion (betting on international sites excluded). ATG, which is a large, state-owned company holding the monopoly of all betting at the trotting tracks in Sweden, currently holds a market share of 28%.

presentation and overview. This helps the users to become less dependent on where sources spatially are situated and to be able to control the pace of incoming information.

2.2 Implications for information management

- Gathered information needs to be structured in such a way that users easily can identify tendencies, i.e. tools that support a general view and indicate performance potential of participating competitors.

The system should provide functionality that allows spectators to manage opinions in an explicit way. Based on the collection of user opinions, the system can present the overall status of a specific competitor or stage of the event.

2.3 Implications for collaboration

- The technology should enable users to individually control with whom they wish to have information exchange with.

Different social constellations are constructed and develop over time. With whom information is exchanged is continuously negotiated and dependent on the social status between collaborating parties (Nilsson & Nuldén 2003). Thus, the application should allow the users to control information recipients, i.e. the user can define who should take part of the information in question at the other end.

- Activities such as information gathering and spectator interaction are often closely intertwined while being mobile. Therefore, spontaneous and situated use of the technology should be supported.

While users move around, they spontaneously meet friends and start to interact. This resembles what has been referred to as “mobile meetings” (Bergqvist, Dahlberg, Kristoffersen, and Ljungberg, 1999), although in a much less formal sense. Since social interaction plays an important role in this activity, the system should allow for the user to initiate interaction, and accordingly, the interface should put a low emphasis on perceptual cues, i.e. audio or visual blinkers, to avoid interference in sessions of social interaction.

3 TROTTINGPAL – TECHNOLOGY SETUP AND IMPLEMENTATION

TrottingPal is a mobile web application system (using common components, e.g. HTML, PHP, Java and SQL databases on the server side), running on a PDA (Personal Digital Assistant) with a color touch-screen display. The users gather and exchange information about participating competitors through a visual interface. The interface features a set of different panes, i.e. services. It is designed to support the spectators in the background while moving around the arena gathering information and talking to other spectators.

3.1 Mobility

Client connection is maintained by using an IEEE 802.11b wireless local-area network. All PDAs were equipped with a wireless LAN expansion card and wireless LAN antennas were connected into a hub linking the local network to the Internet. Two antennas were used during the evaluations, each in one end of the main building in the vicinity of the track (approx. 150m in between). This setup allowed the users to maintain a seamless connection to TrottingPal while being mobile.

3.2 Information management

The system provides a pane containing information about each stage of the event, including competitors, background and current odds information. All information items are continuously

updated over the Internet, i.e. TrottingPal sends queries to an online database/website maintained by ATG[3]. The user can also record own observations into the system and either save them for own reference or communicate them to other users.

3.3 Collaboration

TrottingPal allows for constructing free-text messages or with help from pre-formulated templates, to interact and push information while being dispersed. Each information item present in TrottingPal can always be forwarded to the other users to enable spectators to add, contribute and share information between them. While forming an opinion, the user can specify a number of default recipients that should take part of it. All interaction with TrottingPal, whether it regards to gather information or collaborating with other users, is operated through tapping the screen on simple screen layouts consisting of panes, tables, buttons, and drop-down menus (see figure 1 below).

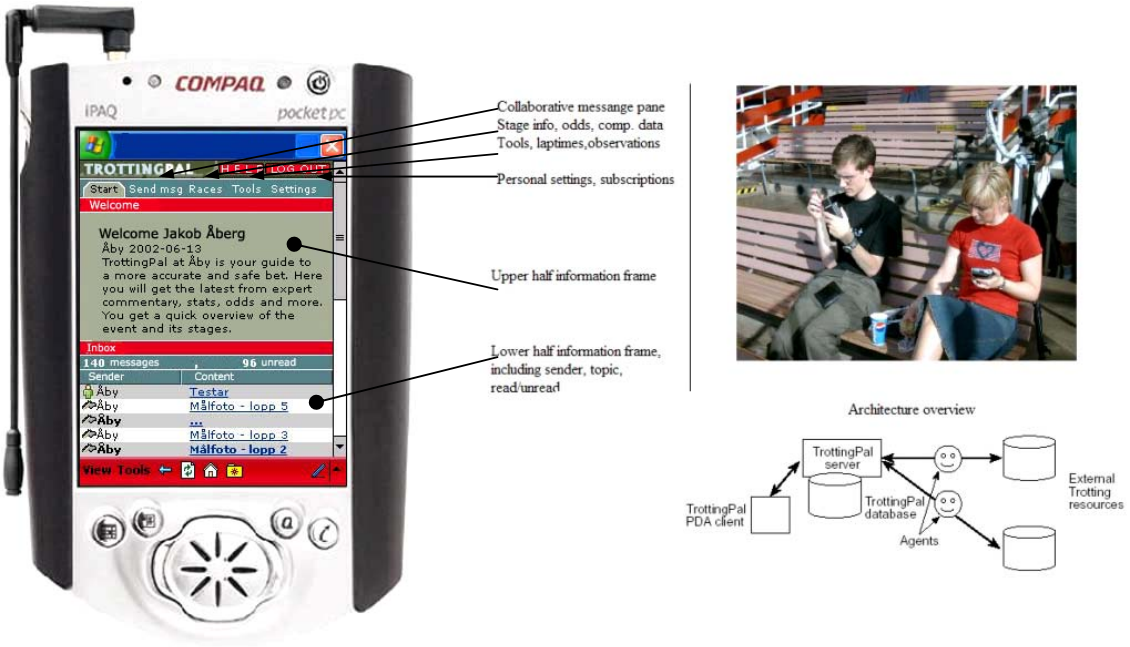

Figure 1. Interface overview (left) with service panes, the collaborative message service (lower half of screen, left) and the main architecture (right).

4 METHOD FOR EVALUATION

To examine the use of TrottingPal in its real setting, two separate field trials were conducted. The first was focused on evaluating the usability of the design to suggest improvements. The underlying intension of this was to separate feedback on issues concerning the technology and the system itself, as opposed to the conceptual use within spectator practices. The latter became the focus of the second field trial, which involved 10 experienced spectators. This approach enabled an undivided focus on spectator activity while testing the system on the intended target group. Although TrottingPal is a fully functional prototype, evaluating it by field trial would naturally impinge on the spectators' "free time". With this in mind together with our goal to investigate the conceptual use of the system's

[3] ATG is a large, partly government-owned company that solely handles the betting on trotting tracks in Sweden. See www.atg.se.

functionality *in situ*, the evaluators were not handed any pre-defined tasks. Rather, they were asked to use it in ways they thought would be appropriate and beneficial.

4.1 First field trial

4.1.1 Participants

For the first field trial, 10 undergraduates at the local IT University were recruited. All of them had advanced knowledge about handheld computers - all of them had skills in developing stand-alone applications for them. However, a majority of them were beginners when it came to attending trotting in general. Three women and seven men participated and they ranged from 22 to 31 years of age.

4.1.2 Data collection

The first field trial lasted for 5 hours during a typical day at the track. Before the evaluation was initiated, the users were briefly instructed how the system worked. During the evaluation, two researchers conducted close observations. Data was collected by taking notes, which later were categorized and analyzed. In addition, all participants completed a questionnaire in order to record their feedback on the use of TrottingPal. The questions posed concerned the intelligibility of the interface, usefulness and was intended to draw out their experience interacting with TrottingPal.

4.2 Second field trial

4.2.1 Participants

TrottingPal has from the beginning been aimed at experienced spectators. We recruited 10 members of the official guide group. None of the members were previously known to the researchers. The field trial participators signed a consent form after they had been briefly introduced to the concept and function of the system. These representatives work (for free and non-profit) a couple of times each week to introduce new visitors to the track premises, such as groups from companies, tourists etc. Most of the members of this group had 10-30 years of experience of attending trotting. Without exception, all participants were men and between 31 to 73 years of age. All had a variety of different backgrounds, occupations and relationships with the others in the group. The majority of the participants had previous experience in using desktop PCs, mostly by accessing trotting related websites. Only one person had previous experience in handling a PDA. Thus, the objective of TrottingPal was explained and they were provided with a tutorial on the included services and basic PDA interaction.

4.2.2 Data collection

During the second field trial two researchers conducted close observations during the whole session which lasted for five hours. By shadowing end-users we could observe enactment and interaction in conjunction to the situation at hand. Data was once again collected by taking field notes, which later were categorized and analyzed. The categories were created by sorting the different situations, actions and interactions that was identified while observing the users. As the field trial progressed, researchers continuously re-visited users to get spontaneous feedback. All users completed a questionnaire at the end of the evaluation. The goal behind this was to record the participants own experience and subjective opinion on how TrottingPal met and facilitated activities such as information management and collaboration. All message traffic in TrottingPal was stored in a database with time-stamped events to survey collaborative exchange, which afterwards was examined and analyzed.

5 FINDINGS

This section accounts for the findings from the evaluation of TrottingPal. We start with reporting our findings concerning conceptual and functional use of TrottingPal. Next findings that concern the usability and suggestions for improvements of the design are presented within the discussion.

5.1 Mobility, personalization and collaboration

At an early stage, many users wanted to explore and gather information in smaller teams of around two persons, being dispersed from the others. A while later, this proved to be the foundation for discussion between them when they once again wanted to be co-located. However, the transformation between being dispersed from the others as opposed to co-located was rather nuanced. Over time they wandered around and switched between these two settings to discuss and argue about the collected information, i.e. to jointly create an understanding of it. One conflict identified was, that the different users focused on completely different competitors while being dispersed, but later on, the conflict was rather used as overlapping input to complement the overall sets of information and tips. In comparison to the data from our previous work, results from the field trials suggest that users coordinated tips earlier during the information gathering process while using technology. Coordinating and collaborating in this sense is about sharing reactions and individual impressions of participating competitors or other forms of event information. During the previous field study results indicated that much information exchange took place among spectators while being co-located, and included a greater amount of collected information. While using TrottingPal, users took advantage of being able to get feedback regardless of where other spectators (using TrottingPal) were situated. As a result, this process was initiated somewhat earlier while using technology and with an identified change regarding setting, that is, spectators were able to instantly share information despite being located away from the others. There are interesting findings to report that suggest how TrottingPal on the one hand serves as a trigger for social interaction, and as fading boundaries for the same on the other. This is about how the spectators put their interactional focus and how they perceived other spectators in situations of being co-located. First, spectators situated within earshot or sight often approached each other and started to interact, holding up their PDA, gesticulating and talking about what they had learned minutes ago. Secondly, we could also see almost the opposite happening, i.e. co-located spectators talking to each other but almost without looking at each other, maintaining focus on the PDA. When users interacted with the application by themselves and another user approached them, they sometimes did not interrupt the interaction with TrottingPal. Instead, they started to talk a while about the current situation and the other user left a while later without the other even looking up. Thus, we found that the application at times faded the boundaries for face-to-face interaction. Repeatedly users joined sessions of social interaction and left again over time while visited users still maintained, at varying degrees, interaction with the system. At times observations were made where interaction with TrottingPal also triggered social interaction between co-located users in the process of trying to make sense of collected information. During these brief sessions of social interaction, co-located users often talked about information arriving from dispersed users, discussing the trustworthiness and so forth.

5.2 Distribution of “work” between different locations

In a sense TrottingPal served as a means to make visible what information that was being sought after for the moment. A user contributing with tips to the other users appeared to start a thread of information gathering in the group. Results suggest, from examining the log files covering the exchange of collaborative messages, that when a user contributed to the entire group with information about a specific competitor, the other users took on the “responsibility” to contribute with information covering other competitors regarding the same stage. That is, to help completing the picture collaboratively within the group. While the users were being dispersed, most of the time was spent on collecting information through interaction with TrottingPal and social interaction with other

spectators. It was also found that the users frequently used TrottingPal on the move for briefings to all members of the user group and to exchange initial reactions on incoming information. Naturally, the co-located setting allowed for richer interaction and enabled users to go into details during face-to-face sessions. Occasionally, users also used the co-located setting for more thorough coordination and decision-making, i.e. on how to place their bets, before once again moving away to collect further information. During our previous work, which informed the design of TrottingPal, evidence suggested that with whom certain information is exchanged is continuously negotiated. In other words, the willingness to share valuable tips and information is dependent on the social relationship between spectators. Some observations were made of the same occurrence during the second field trial. TrottingPal allows its users to specify recipients for collaborative message exchange, that is, each user can define a set of default recipients, but a message can also be targeted at one single individual. The users seemed less reluctant to share their findings with all members of the group while using the technology. Mostly message exchange "peer-to-peer" took place between users that earlier had wandered around together and later were dispersed from each other. However, a majority of the collaborative messages were sent to the entire group (~80%). We believe that this needs further examination to uncover more long term effects.

5.3 Mobility - spaces and places

One important finding was about how the arena was spatially used. During the field study, observations were made of spectators visiting the betting hall (where cashiers handle the betting) mostly for money transactions. During the evaluation, several users reviewed event information, using TrottingPal, within the hall and also initiating social interaction with other TrottingPal users in order to coordinate final opinions prior to placing the bets. This stems from the fact that the hall is located a bit away from where spectators have a good overview on the situation, and is therefore often avoided until the last minute. It is situated "in the back" where spectators do not have visual contact with, for instance, the track. The betting hall has no seats, it consists of a row of counters where clerks receive bets and small, round tables at the level of ones elbow for people to fill out their betting forms. TrottingPal rendered a seamless access to event information, which enabled users to make better use of this space. In this sense, TrottingPal spatially moved the process of jointly creating an understanding of gathered information and deciding bets into new spaces. Table 1 below illustrates how the different spectator activities turned out to be organized during the field trials while using technology compared to previous empirical work. The categories are explained below.

Activity	**Setting**
Information gathering	Dispersed
Coordination	Mobile meeting
Making sense	Co-located

Activity	**Setting**
Information gathering	Dispersed
Coordination	Dispersed
Making sense	Mobile meeting, Co-located

Table 1. LEFT: Taxonomy of spectator activity and setting within spectator practices. RIGHT: Taxonomy of spectator activity with regard to setting while using technology.

We define the different settings, activities and their distinctions as the following. Information gathering is the continuous, ongoing activity in which spectators collect and build up information and knowledge during their stay at the track. Being dispersed corresponds to being located away from their friends, locally at the track during this process. Mobile meetings occur when wandering spectators, more or less familiar with each other, meet and start to interact in a spontaneous fashion. In this work we make the distinction between a mobile meeting and being co-located as: a mobile meeting is unplanned, spontaneous and rather brief. We consider being co-located as remaining present in the company of others during an extended period of time, which renders the opportunity for more detailed and thorough interactions. Coordination as activity is here defined as negotiating general facts and tips between spectators in a brief manner; it is often an opportunity for getting an impression of the focal point of discussion. Moreover, making sense is here regarded as thorough coordination of beliefs,

interpretations and anticipated outcomes of the event. It takes place during longer meetings where spectators are co-located for an extended period of time. It was found that TrottingPal enabled spectators to become less dependent on where other users were situated. Initial coordination took place on the move, being dispersed. Further, when spectators had an increased exchange while being dispersed, sessions of face-to-face interaction were more focused on making sense of collected information. The depth of analysis was instead determined by the length of interaction.

6 DISCUSSION

In this section we discuss the findings of this user study in light of conceptual contributions in the literature regarding notions of place and space. These research contributions are used to guide the analysis further. The analysis focuses on spectator mobility, in terms of how spectators treat and make use of space as opportunity for meaningful action (place).

Many collaborative systems use some kind of notion of space to facilitate and structure interaction. Harrison and Dourish (1996) argue that the focus on spatial models is misplaced:

"We argue that the critical property which designers are seeking, which we call appropriate behavioral framing, is not rooted in the properties of space at all. Instead, it is rooted in sets of mutually-held, and mutually available, cultural understandings about behavior and action. In contrast to 'space', we call this a sense of 'place'. Our principle is: 'Space is the opportunity; and place is the understood reality' " (Ibid).

To clarify, they use the metaphor of the distinction between a "house" and a "home". The house keeps the weather out, but a home is where we live (Harrison and Dourish, 1996). Ultimately this attempt to define the conceptual distinction between space and place is used to frame appropriate behavior. Based on this understanding, some light can be shed upon the context of the trotting track where we have introduced technology. Herein, the notion of space can be described as different sections of the arena, i.e. restaurant areas, grandstands, and designated areas for observing the competition in close proximity of participating competitors. These different spaces have a rather obvious, designated purpose for the intended activity. Harrison and Dourish also stresses that behavior can be framed as much by the presence of other individuals as by the location itself (viewing the term place).

Brown and Perry (2002) add to the discussion concerning space and place and present a critique of the conceptual work by Harrison and Dourish (1996). They acknowledge a practical value of the given framework, but argue that the view on how technology comes to be used in everyday action is too simplistic. They further argue that Dourish's discussion does not put a proper emphasis on activity, which would benefit from being viewed as features of ongoing action. Subsequently, there is no meaning of place without some activity (Brown and Perry, 2002). However, in this paper we are not choosing a philosophical basis concerning the tension between space and place. The mindset provided by Dourish and Harrison (1996) is rather used as an analytical *tool* when considering the derived findings. In this research, space is viewed as the geographical boundaries that constitute the arena as a whole, and as its subset, i.e. how it is divided into designated areas for the spectators. Further, place is interpreted and analytically used as the opportunity for spectators, through their enactment, to bring social meaning and collaborative capabilities to the situation at hand.

In the context of the trotting track, place assumes a rather fluid notion. Some people regularly visiting the track can have a cultural, shared understanding that it is likely they will find their friends at certain spaces, but place is constantly changing. Place occurs when spectators meet and can have a fruitful session of interaction in order to collaborate, coordinate and to make sense of event information. The prerequisites for this to happen or work are that they are in relatively close proximity of each other, or in a more spontaneous fashion, i.e. a mobile meeting. An illustration of spectator practice is made in figure 2 below, that is, before we introduced technology into the context. The illustration represents two individual threads of action of two spectators, in this example the information gathering process which we perceive as ongoing and continuous. This process involves contact with a number of

distributed information resources, which leads to extensive mobility. The two threads of action intersect at points where spectators meet in space, creating the opportunity for collaboration and interaction, i.e. in line with the notion of place. Thus it is shown how activity and setting over time acts as prerequisites for collaboration and interaction.

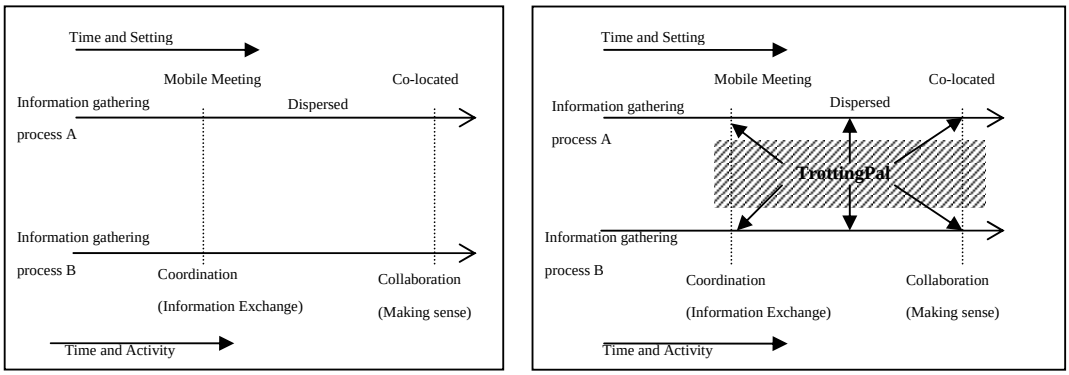

Figure 2. *LEFT: Two separate threads (A and B) of action regarding two spectators and thread intersections (vertical, dashed lines) that enable sessions for collaboration and social interaction. RIGHT: Technology as a layer creating flexibility and opportunity for spectator collaboration and interaction, i.e. making place in space.*

Naturally, there is no explicit distinction made between coordination and collaboration. These activities are different instances of social and information exchange. However, it was found, that deeper analysis and collaboration takes place during a meeting that lasts a little longer than a brief session of coordination, triggered by a spontaneous mobile meeting. The information gathering process is an on-going activity, which is "interrupted" when A meets up with B. These briefing sessions are then adjourned for the moment and the gathering process is resumed. Accordingly, the setting which the spectators are situated in is an important prerequisite for successful interaction and collaboration. Next the influence of technology is illustrated in figure 2 to the right. As shown in the figure, results from the field trials of TrottingPal suggest several effects on spectator practice. When technology was introduced into the context, spectators became less sensitive to the influence of space, and at the same time, place transforms into something more fluid. The use of TrottingPal enabled initial coordination of gathered information while being dispersed, without a mobile meeting being a prerequisite for this to be feasible. Further, when spectators were dispersed from each other, the application enabled briefings to the group, sharing knowledge and distribution of work. TrottingPal makes way for place in the sense that the users are provided with the opportunity to enact their cultural and social understandings in a loosened up setting. Therefore, place breaks up further from space and assume a fluid character. We have designed for appropriation of technology. Despite acknowledged potential of this personalization feature, the adoption within the community and its integration into the established practice has to overcome the barriers of time (Harrison and Dourish, 1996, p. 70), which goes beyond field trials. The feature supporting social negotiation of collaborative message exchange suffers from the same constraint. These issues are part of our future work.

6.1 Suggested improvements for re-design

TrottingPal retrieved odds information from the same source over the Internet as is being used for display at the track (updated continuously several times per minute). However, the intervals for updating the data differed between existing technology and the mobile application (approx. one minute between each update). Thus, to some extent, this caused a bit of "worry" concerning information validity. Although after a while, users noticed that the two sources followed the same development over time and felt more comfortable. But, for this to work more smoothly, the system network needs a close integration with existing technology. A large majority of the users found the dynamic odds pane

to be informative and useful since it enabled them to access it regardless of their location in relation to the large odds panels at the site. Further, the collaborative service and grading comparisons were also ranked high and considered valuable. However, the browser used is far from as competent as a browser on a desktop PC. This puts limitations on interaction and most importantly, when new information is to be updated within the application. For instance, the handheld explorer browser could not refresh parts of page, i.e. frames or fields. Instead the whole layout needed to be reloaded to display updates. This resulted in a lot of inefficiency. Therefore, we will consider using an improved browser or platform in future attempts. Moreover, there were no intrusive cues that notified the users of available updates until he/she interacts with the system. Although this was taken into account as a design parameter for social interaction, users could at times miss that new messages had arrived and also repeatedly hit the refresh button but with no new information to collect. Naturally, people differ in what they perceive as intrusive, which has found expression in i.e. the possibility to personalize mobile phones. The total lack of interactional cues seems to have lead to an extreme on the other side, i.e. the problem raised above. One way of accommodating this could be to provide a set of cues from which the user can choose. Not surprisingly, the PDAs consumed a lot of power due to constant network activity. Accordingly, a corner was set up where users could swap PDAs to avoid interruptions of the evaluation. One possible future solution is improved network utilization to further decrease consumption.

7 CONCLUSION

This paper has presented findings of two field trials that have introduced TrottingPal into spectator practices. The context of the trotting track poses a variety of interrelated activities, a constantly changing social context, and concerning the interplay between users while collaborating towards a common goal. The results from the field trials of TrottingPal suggest that relevant findings for design of the system have been taken into account. Still, there is room for technical improvement and aspects suitable for more extensive studies. The research question posed was: *How can mobile technology serve as a tool and generate value within spectator practices at the trotting track?* The main contribution shown is that TrottingPal serves as creating *opportunity for place*, not exhibiting it. The use of technology suggests changes to how space and place is treated and used. The paper has also brought the following main results forward. TrottingPal facilitated to make way for place in spaces that previously had been avoided due to decreased information support. The notion of place, among the users, has also been extended in terms of enabling a more seamless way of coordinating and collaborating. In addition, the field trials also indicate a change in the boundaries for face-to-face interaction while using the system. Putting these findings together in the light of spectator practice, TrottingPal has met and facilitated the important and preparatory steps of information management and collaboration, maintained seamlessly in a mobile context. We believe that these findings have relevance for research into collaborative systems that seek to support mobile users in a local, yet distributed context outside the workplace. The next step of this research is to conduct a more long-term evaluation of the technology in use. Another interesting aspect that we intend to examine is the business potential of introducing mobile services in this context, i.e. looking at the various stakeholders and how IT support can enhance existing relationships. One issue that the technology has not succeeded to accommodate is how to reach a more clear integration with existing technologies. Much of the spectator practice relies on using well-tried artifacts, which are integrated in their existing culture at the trotting track. This renders barriers for new technology that is introduced into the context. To accommodate this, one solution can be to investigate development of support to augment the awareness between TrottingPal and other sources of information. This would ultimately make way for users to gain a genuine trust in information validity. Another aspect worth investigating is to create improved awareness cues between co-located and dispersed people, especially while making more use of space and where other spectators are spatially situated.

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