The Interactional Organisation of Location-based Gaming

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Abstract: This paper describes a study aimed at gaining insight into the interactional accomplishment of collaborative game play. Mobile, location-based games are commonly believed to hold great potential for creating novel and immersive learning experiences, but little have been done to unravel the practical details of how such games are actually played. To address this issue, a mobile, location-based game for teaching and learning history have been designed, deployed and the participants' activities were video taped. The focus of the study is how the participants make use of the resources available in the game space and how these resources, including the historical narrative, feature in the participants' practical accomplishment of the game.

Introduction

This paper describes a study aimed at gaining further insight into the interactional organisation and practical accomplishment of collaborative game play. A location-based game for learning history has been designed and deployed and we have video taped students playing the game. The analysis focuses on how the participants used the resources available to them in the game space: the game itself on the GPS-enabled mobile phone, and the urban environment and physical surroundings. Playing the game involves moving around in a city landscape and focus is also set on how the participants make these resources available for each other and how they engage with the material presented in the game instructions. This includes how the participants relate to the historical narrative presented in the game, in and through their interaction, and how this is seen in relation to the historical aspects of actual locations and surroundings. Much of the game play is constituted of mundane, everyday activities such as way finding and orientation in the urban environment, and attention is also set on how these activities are interactionally accomplished and how the resources and their knowledge of the local geography feature in the activity.

The text has the following structure. The first section is dedicated to a short review of relevant studies, such as studies entailing the use of mobile technology and games within the field of CSCL, and video-based research. Then we describe SILO, our technological architecture for creating mobile games, and the mobile game, Premierløitnant Bielke (PB). Next we present our study, including the research focus and methodological approach, and the analysis. Finally we present and discuss our findings.

Mobile, Location-based Computer Games and Learning

The use of mobile technology to support collaborative learning has been discussed within the field of CSCL for almost a decade (see e.g., Roschelle & Pea 2002; Roschelle, Rosas & Nussbaum, 2005). Tools have been developed and studied, both to support collaboration in the classroom (Chang, Wang, Chen & Liang, 2009; White, 2006), and to provide support when moving into the field (Lyons, 2009; Yatani, Sugimoto & Kusunoki, 2004; Tan, Liu & Chang, 2007).

Computer games have also become increasingly used and studied for their educational potential (e.g., McFarlane, Sparrowhawk & Heald, 2002; Kirriemuir & McFarlane, 2004; Shute, Rieber, & Van Eck, in press), also within the field of CSCL (e.g., Ke, 2007; Rosenbaum, Klopfer, Broughner & Rosencheck, 2007; Satwitcz & Stevens, 2007; Klopfer, Perry, Squire, Jan & Steinkuehler, 2005). Bennerstedt and Linderoth (2009), for example, have studied gamers' practices within multiplayer online role-playing games to discover how they are dependent on generic social skills such as use of language. They approach the game of World of Worldcraft as a knowledge domain, and through the use of interaction analysis they show how the participants in the game "make visible what they see as relevant knowledge objects" (Bennerstedt & Linderoth, 2009, p. 410).

The terms ubiquitous and pervasive computing shares a high degree of similarity (Dourish, 2004), and have been used to refer to technology and computer *use* that is not limited to taking place in front of a screen connected to a stationary computer. Technologically, pervasive computing usually relies on devices for sensing and positioning the user, such as GPS or Mobile network base stations, and devices for facilitating an information exchange dependent on the user's location, such as RFID tags, 2D barcodes or Bluetooth.

Mobile, location-based games, refers to a subcategory of ubiquitous and pervasive computing. In such games the physical and cultural surroundings, for example an urban area, are made an integral part of the game space and the location of the gamers is a key aspect of the game-playing activity. The games add a digital layer to these environments, creating a game space where players can explore familiar urban spaces in a new context. Thus, location-based, mobile games represent a new kind of game compared to both traditional console-games

and physical games; one that has potential for providing novel learning environments, for example by facilitating the embedding of (abstract) concepts in the contexts of their actual use (Kurti, Spikol, Milrad, Svensson & Petterson, 2007; Kurti, Milrad & Spikol, 2007).

Little have been done, however, to unravel the practical details of how such games are actually played, and subjected gaming activity in mobile, location-based games to detailed empirical analysis at the level of interaction. Such analyses have the potential to reveal the interactional organization of the game-play and how different aspects of a given game are made relevant *in situ.* As mentioned above, the analysis presented in this paper aims at offering this kind of insight into the practical accomplishment and interactional organisation of gaming. There is a body of research inspired by ethnomethodology and conversation analysis relevant for this study, especially studies where the use of technological resources features as a central component in the analysis (e.g., Heath & Luff, 2000; Suchman, 2007). A key issue in these studies is the use of video recordings in the analysis (Heath, Hindmarsh & Luff, 2010). Recently, the use of video-based research has gained a certain momentum in CSCL and the learning sciences (for a recent overview see Derry, et al., 2010). As Koschmann, Stahl and Zemel (2006), point out, a key analytical commitment in such studies is "to discover within the recorded materials what the members are actually accomplishing (...) and are making relevant (…) through their interaction" (Koschmann, Stahl & Zemel, 2006, p. 7).

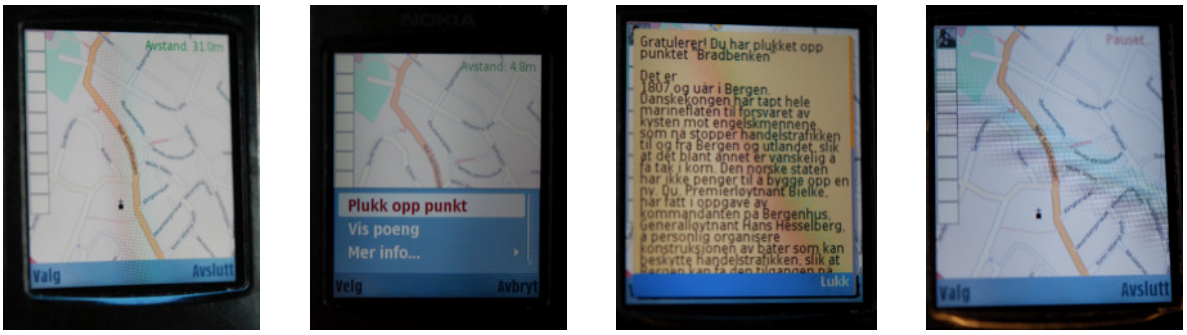
Goodwin (1994), in doing a detailed study of the field work of archaeologists, shows how they make certain aspects of their physical surroundings relevant and visible to each other in interaction, and in this way highlight objects as relevant in the given context. While Goodwin's study is focused on activities that take place in a relatively limited area, his insights are still relevant for understanding how participants, through their interaction as they move through an urban area, give relevance to different aspects of their surroundings and thereby how they perceive these surroundings. Recently, Brown and colleagues (Brown & Chalmers, 2003; Brown & Laurier, 2005; Brown, et al., 2005) carried out a series of ethnomethodological studies of mobile technologies that ranged from simple paper maps to hand held tablet computers. These studies highlight how the participants organised their way-finding and navigation, how they oriented themselves in their geographical surroundings and how they made use of the different available resources. This was all studied at a detailed level of interaction and shows how such activities are practically accomplished and how the use of navigational resources such as a map features in the organisation of these activities. All the above-mentioned studies have informed the analysis presented below. First a description of the game design is presented.

SILO and Premierløitnant Bielke

Premierløitnant Bielke (PB) is a mobile, location-based game for teaching and learning history. It builds on several technological resources, and was created using the SILO system. This section briefly describes SILO and PB (see Wake & Baggetun (2009) for a more detailed account of both).

SILO is a web-based system for creating mobile, location-based games. It permits a game creator to construct a storyline as a set of missions, and attach the different missions to different locations, by clicking on a map, displayed on the screen. Aside from the storyline, the game creator can add icons and set limitations on time, and configure user data, in addition to a maximum of three hints on how to find each location. When all the parameters of a game are specified, they are put in a zip-file that can be transfered to the phone. The mobile application then unwraps the game parameter file, and creates a game. SILO is designed to be easy to use, making it possible for non-technically oriented persons to create games, for example teachers who have an idea for a location-based game for their students.

When the game is being played the application displays a mission (i.e., a description of the next location from the storyline), a marker indicating the participant's current location and the number of meters to the next location, a scrollable map (see Figure 1a), and a track displaying the history of their movement, a set of icons indicating progress in the game, and their current score. While the game is being played the application is constantly calculating the distance to the next location. This is displayed in red until the players near the location – when it turns green and they can pick-up the location (see Figure 1b). They are then congratulated and offered a text that describes the next location (see Figure 1c). The game then pauses, to allow the group to think about what to do next, and an icon signalling that they have picked up the previous location is displayed (see Figure 1d). The game is over when the last mission is solved (i.e., the last location is found). The application continually saves game data so that the game can be restarted and continued from where a game was left (e.g., if a participant accidentally switches off the phone, the participants can restart the game, and continue from where they left off).



(a) (b) (c) (d)

Figure 1. The Mobile Interface of a Game Created by SILO.

The PB Storyline: Bergen during the Napoleonic Wars

The main idea behind the game PB is to use both the concrete geographical surroundings relevant to a historical setting, and a storyline about the same setting in a game, creating an *ad hoc* museum for the purpose of teaching and learning (Wake & Baggetun, 2009). Thus, a novel and immersive experience of history is provided, in a way not possible in the classroom. Furthermore, it is envisaged that the presence of actual buildings and sites, relevant to the history in question, will facilitate reflection over the same history. The game PB is about Bergen, Norway during the Napoleonic Wars. This was a period of distress in Bergen, as the war with Great Britain led the British to block trade routes via the sea. Due to the resulting scarcity of food and supplies, the citizens of Bergen needed to amend the situation, and decided to build small, rowed gunboats to defend merchant ships against the larger British frigates. The game is about the building of these gunboats, and the players are to virtually collect their different parts and accessories, by visiting the actual sites where boat parts and accessories were being produced in Bergen, in the early 1800's. In this way, we highlight the different trades and vocations that were important to the marine trade hub that Bergen was during this period.

PB is designed to be played by groups competing to first complete the set of missions. The groups navigate the area of Sandviken, Bergen in search of locations described in the set of missions. Once they have received a mission, they orient themselves and wander to the location with the aid of the available map, location indicator, distance to next location, up to three hints, and the physical surroundings. When they have found the location, they pick it up and receive the next mission. The group can then reorient and make decisions about where they need to go to find the next location. The game ends when they pick up the last location. The group with the lowest score, consisting of a sum of time and number of hints used, wins.

Research Design and Methods

The gathering of video data and their analysis reported in this text is a continuation of a series of empirical studies of the game of PB. The previous experiences with deploying scenarios of the game, has also been reported on elsewhere with focus on usability (Wake & Baggetun, 2009) and on integration with a web-based publishing tool for integration of the gaming activity with classroom learning activities (Baggetun & Wake, in preparation). The overall research design is based on creating learning scenarios inspired by designed based research (Barab & Squire, 2004), where the deployment of the game is studied and this informs the redesign of the game and the scenario.

In order to study the practical accomplishment and interactional organisation of the game playing, we organised a field trial where the main body of participants were master students in a course in CSCW at our department. Twelve participants were divided into five groups of two or three, and filmed while playing PB.

Nine participants were master students at our department. Two of the participants were acquaintances and the last was a PhD candidate from our department. For the master students, the gaming activity followed a lecture on technologies for mobile support of work, and ubiquitous and pervasive computing in general, in addition to a short introduction to the game. The technological structure the game builds on, and the historical background for the game was presented. (For the remaining participants a quick introduction was given on site as part of the briefing.)

The empirical material consists of seven hours and 15 minutes of video recordings. The average duration of the recordings is 1h 26mins, the shortest 1h 17mins and the longest 1h 46mins. The corpus of video data has been logged and transcribed. This material formed the basis of our analysis.

The first two groups were filmed simultaneously with two different video camera setups, one with and one without an extra wireless microphone attached to one of the participants. The remainder of the groups were filmed with the additional wireless microphone attached. Filming location-based game players in an urban milieu represents a set of practical challenges compared to filming classroom activity, largely in the sense that the potential influence of environmental factors on the quality of the video is higher. One is factor is the quality

of sound, as noise from, for example traffic, construction work, treading on snow and bystanders' chatter made reconstruction of speech difficult when an extra microphone was not attached to the participants. The recordings with the wireless microphone, however, are of good quality and were relatively easy to transcribe. Another factor is that the choice of camera angle is challenging. When the groups were moving around, it was difficult to capture footage from another angle than behind the group, as the groups' movement was volatile and discrete. This for example made it more difficult to capture what they were looking on at the screen, and their facial expressions. Still, when they stopped to find the locations, we were able to get good footage of most of these situations. We were able to reconstruct what they were looking at on the screen when they were talking about it (from the audio track), however, and also to some degree from the groups' current location and activity.

Analysis of Game Playing

The analysis of the empirical material revealed an emerging structure in the groups' game activity. In this section we present the structure of the gaming activity. The overall activity structure consists of four phases: 1) Briefing, 2) Search and orientation, 3) Arriving at a location, 4) Receiving instructions. There is iteration over the last three phases, until the final location is reached. Each of these is described below.

Briefing. At the beginning of the game, the participants in each group are given a briefing on the aims of the game and how it works by the game facilitator. This includes showing the directions to the first location.

Search and orientation. During the search and orientation phase, the group moves towards a location. Having received and read the instructions, the group carries out an initial orientation and starts walking. When they needed to adjust their direction, they do so in several ways. One way is that the person carrying the phone reads out loud the distance to the next location. A second way is when a group member verbally suggests that the group is moving in the wrong direction. A third way is markedly changing direction, sometimes together with a comment of some sort.

Arriving at a location. In this phase, the groups establish among themselves whether they have arrived at the intended location. Arriving at the location could mean that the GPS numbers turned green indicating that they are within the zone of the location allowing them to "pick up the spot" to proceed in the game. In addition, they have to consider whether they can identify the actual physical location (the building, object or area). The completion of this phase, in terms of picking up the spot, varied. Either they identify the physical location at a distance and then zone in on the location and pick up the spot, or they enter GPS zone, and pick up the point without identifying the actual physical location. This varied with the groups and the different locations in question. Picking up the spot concluded the phase of zoning in on the location.

Receiving instructions. Instructions on how to find a new location are received on the phone, as the starting point for the search for the next location. The instructions are shared in one of two ways. Either the person carrying the phone reads the instructions out loud to the rest of the group, or they position themselves in a way where each of them can each read the instructions on the display simultaneously.

The groups iterated through the last three phases, searching for and orienting towards a location, zoning in on it and receiving new instructions, until they arrive at the final location where they receive a final message containing historical information that concludes the game.

Interaction in the Game

An episode from one of the groups' game play (a group of three) has been selected to illustrate how the participants organised their gaming activity in the different phases and how they make decisions concerning their involvement in the game, how to play it, and how this is organised in and through interaction. (Excerpt 1, translated to English from Norwegian, and anonymised.) The episode is one minute and nine seconds long, and starts where the group is in the search and orientation phase after having picked up five of the total nine spots in the game. They are trying to find the sixth spot and are walking down a road (see also Figure 2, images used with permission of the participants).

Excerpt 1:

1	Anders:	No, it is fort- forty se::ven (0.2) and now it is forty three and the next is forty one (2.1) I'm sure it's the building that burned down, don't you think? Hehe	Walks
2	Bård:	(2.3) Recently?	
3	Anders:	(3.0) Let's see (0.3) no wait a second (0.6) Now we were actually within I think, and then (2.8) (Let's see) (3.0) We were actually supposed to be a bit further down I think, but eh (0.7) we are at least allowed to pick up the next point here	Stops, turns Walks back Stops
4	Chris:	Hehe (0.8) Yess (0.6) Where's the river then?	
5	Bård:	The most important thing is to win, not that we are supposed to learn so much?	
6	Anders:	(Th) true. Eh. (0.8) It [depends, it depends if it	

7	Bård:	[Maybe it is down there?	Points towards location
8	Anders:	>Maybe< (1.0) >You have picked up, eh, the point Bøkkerne, Message from Hesselberg: good work Premierløitnant Bielke, the barrels will be handy at sea< (0.5) Now you have most (0.4) of what you need to build the boats (0.4), .hh, as they are supposed to, drawings, money, ropes, hh, barrels, gunpowder, you only need to pick up cannons and cannonballs before you can go to the shipyard and get the construction started (0.8) Before you do that, it would be nice to quench your thirst, have a beer, [he he,	Reads from phone
9	Bård:	[Heh	
10	Anders:	.hh, and something to eat at Lars Evje's inn which is located (0.9) eh, along the sea in the direction of Åsane, yeah, I know where Åsane is.	Reads from phone Turns, walks

In turn 1 Anders is reading the GPS numbers from the phone as they walk. As we have noted, these numbers indicate their distance to the next location. By reading these numbers Anders makes the numbers available to the other participants and in this way makes them a potential resource in their joint orientation. Then he makes a joke by suggesting that the next location is a building in the vicinity that recently burned down — his last utterance in the form of laughter at the end of the turn further supports that this is meant as a joke. In turn 2, Bård asks when the incident took place, and by this indicates that he isn't aware of this — and thus accounts for his lacking response to the joke. The question remains unanswered.

In turn 3 Anders makes a change of topic and returns to the orientation. He says "Let's see, no, hang on". The first part of this utterance can be understood as an indication that he has some new information based on his reading of the display that contradicts their current movement in the given direction, (this is also made explicit by saying "no" in the middle of the sentence). In addition, this is a common way of saying that you are thinking or preparing the next statement. This is reinforced by the second part of the utterance "hang on", which also is a common way to make a bid for the next turn. While he is making this utterance he turns around and then begins to walk in the opposite direction right after he has finished talking. This point in turn 3 can also be seen as the start of the phase *arriving at the location.* Then Anders says, while walking, that he thinks they just were within the zone where they could pick up the next spot. This clarifies his abrupt change of direction. The other two participants turn around and follow Anders.

Now Anders has moved close to a fence and stops. He then says that they actually were supposed to be in another place. He does this by using the word "actually", and the chosen verb form "should have been" further indicates that it is someone's intention that they should have been at another location which is further down below the fence. Then the "but, eh" suggests that they will not do that. He then says that they can pick up the spot from where they are. Chris, in turn 4, asks where the river is. This refers to the text describing the next location they received at the previous location, where a river is mentioned. In this way the utterance is also in reference to the location they were supposed to be in, mentioned by Anders in turn 3. Simultaneously, Bård makes an ironic comment on their situation (turn 5). He says that the most important thing is to win, not to learn. This can be seen as a kind of evaluation of their predicament. They know they are supposed to be in another place, further down, below the fence, but they are allowed to pick up the spot in the game (since they are within the perimeter of the location, according to the GPS signals). This will save them time and thus increase the chances of winning the game. Anders answers "true" to the comment suggesting that he agrees and starts a statement that modifies this first agreement by saying "it depends". Bård simultaneously says that it might be down there, pointing down below the fence. Picking up the spot from where they are would save them the time and effort it would take to walk down to the physical location to which Bård is pointing. This would, due to the geography of the location, imply walking around several blocks. Anders repeats "it depends" but stops, and makes a short reply to Bårds statement, by saying "maybe". While they were discussing their location and where they were supposed to be, Anders has, obviously, picked up the spot on the mobile, and have now received the text. He then starts reading from the phone. This ends their discussion and removes any doubt as to whether they should actually go and find the physical location. In the last turn (10), he is reading from the phone that the next spot is in the direction of a suburb of Bergen, Åsane. He then turns around and starts walking, while saying that he knows where Åsane is.

Figure 2. Participants at Location.

As it is evident in this analysis, there are many things going on in this episode. We see how their joint orientation and movement involves both making the readings from the GPS available within the group, the use of bodily orientation and movement, and explicitly taking up and discussing where they are heading. Further we see an example of how they make some of the aspects of the game explicit and a topic of discussion (such as deciding on whether to find the physical location). We also see how the sequential structure of the talk and interaction is an important resource in the interactional organisation of the game play. It is also shown how this is a collaborative effort and that the game play relies on a number of contingent circumstances depending on how they navigate through the city streets and make use of the resources available to them, such as their knowledge of the city's geography and how they align this with the navigational resources offered through the phone's GPS and map, and the hints provided by the textual descriptions in the game.

Discussion

One key issue that is visible in the interaction and sheds further light on observations made in earlier phases of analysis in the project (see also Wake and Baggetun, 2009), is that there seems to be a contradiction between immersion in the game in the sense that winning the game is set up to use as little time and hints as possible, and time to dwell and reflect upon the historical aspects of the setting and the actual buildings and sites of historical significance. In the episode analysed above, the participants choose to move along without clearly identifying the physical location. Other groups, in other episodes in our material, spend more time and effort on finding the actual location, and are less oriented to move along quickly. This variation is, to a certain extent, dependent on the design of the game and the physical layout of the location in question, but ultimately something that is decided through the groups' interactional organisation of their game play. As is apparent in the analysis, Bård topicalizes this aspect in turn 5 in the excerpt. This statement is, as such, recognition of the dual purpose of the scenario. On the one hand, through this statement, the educational aim of the game is recognised; they are supposed to learn something about history. On the other they can approach this as a game where the important thing is to win. A similar finding is analysed by Hemming, Randall, Marr and Francis (2000), when they discuss how the "educational' character is 'there to be seen', and seen in the detail of activities" (Hemming, Randall, Marr & Francis, 2000, p. 224) of schoolchildren's visits to a museum. They look at how, even though there are clear educational goals and pedagogical inscriptions found in the arrangements and artefacts, the lessons to be learned "are contingent, in situ achievements of the parties to the interaction" (ibid., p. 234).

Another issue related to learning from the game is visible in turns 8-10 in the excerpt, where Anders reads out the text describing the mission to find the next location in the game. This text can be understood as instructions to the group, if understood and followed accordingly, will ensure the group's progress in the game. Suchman (2007), building on Lynch, Livingston and Garfinkel (1983), describes how the problem of following instructions "is to bring canonical descriptions of objects and actions to bear on the actual objects and embodied actions that the instructions describe" (Suchman, 2007, p. 111). In other words, turning the received, necessarily partial, instructions into something that can be recognised and practically accomplished – something that can be carried out. In the excerpt we see how Anders reads quickly through the narrative description and in and through this speedy reading checks that there is nothing they need to do with the information presented. Then in turn 10

when he recognises the referred place, Åsane, he immediately construes this, by stating that he knows where it is, as something that can be acted upon, and then turns around and walks, followed by the two other group members. In this way, the instructions are acted upon on and carried out through their embodied actions in the local environment.

Brown and Chalmers (2003) have discussed how way finding with various resources is a central part of tourism, and an activity through which tourists learn about the place they are visiting. This is relevant for the game play in this analysis. As much of the game play consists of activities, similar to those of the regular tourist, such as way finding and navigating in an urban landscape, an important aspect of the game is getting to know the city in a new manner – connecting the historical narrative to actual buildings and sites. This involves both engaging with the resources available through the game, but also bringing their knowledge of the local environment and geography to bear on the instructions and information presented in the game. Furthermore, the different characteristics of the urban, physical environment are used as game clues and information in order to complete the game. This was supported by the design of the game, by bringing hints about the physical environment into the game missions. In the analysed episode, however, the physical environment acted as a constraint in finding the location they were looking for, as it was visibly a long walk from where they were. Other episodes illustrate how participants used street-names, signs containing historical information set up by the local government of Bergen, and identifying characteristics of the environment referenced in the mission text as means of orientation in the game. This shows how the resources available in the game vary depending on the participants' navigation in the urban environment and how they in the practical accomplishment of the game play must deal with such a variation of contingent circumstances.

Concluding Remarks

This paper has presented a study of the interactional organisation and practical accomplishment of collaborative game play in a location-based game. Through analysis of the video-based material, the study has addressed how the participants in the gaming activity use the resources available to them in the game space, and make these resources available to each other as part of the practical accomplishment of game play. One of the practical aspects of accomplishing the game is related to navigation and way finding in the urban environment. A key issue that have been discussed is the apparent contradiction between the competitive features of the game and time to dwell on and reflect upon the historical aspects of the local environment as highlighted in the game, and how this was resolved at a practical level in and through the participants' interaction.

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