MobiMissions: The Game of Missions for Mobile Phones

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Abstract

Mobimissions is a location-based pervasive social game in which players use camera phones with location-based capabilities to create, share and reply to real-world missions. Missions and their responses are defined by sequences of digital photographs and text annotations. Players create missions, search locations for available missions, create responses to and submit missions for others to find. They can visit a website to review and rate all missions and responses. Feedback from a trial involving 11 players over five weeks reveals patterns of play, preferred locations for play, the limitations of location-based play, and the need for greater social awareness and exchange. Future directions for such location-based social games are suggested.

Keywords: Mobile phones, games, learning, locative

1 Introduction

Several recent projects (see, for example Rogers, et al (2002) and Lonsdale et al 2003)), have taken advantage of the portable and location-aware properties of mobile devices to support a situated learning approach, allowing learning to happen in authentic and appropriate contexts. Research has also pointed to the potential of mobile devices in mobile computer-supported collaborative learning (MCSCL), and through creating shared conversation spaces where learners can share and interrogate their perspectives on the world. (Naismith, Lonsdale et al. 2004). Game play research also suggests that playing games is often both an engaging and motivating activity (Malone, 1981), but can be as much about a process of collaboration and social interaction as progressing within the game (Tobin 1998).

Several studies have also investigated how mobile phones are deeply implicated in young people's social practices as tools for sharing and exchange that establishes and reinforces social ties (Taylor and Harper, 2002; Weilenmann and Larsson 2001; Yoon, 2006). Far from the individualising and globalising tools they are often seen to be, these studies show how mobile phones often support local social activity and mobile phone practices are articulated through local patterns of social behaviour. Mobile phones are thus increasingly the focus of investigation as tools to support social and collaborative learning.

A key feature of contemporary mobile phones is their inclusion of inbuilt digital cameras to the point where tens of millions of people worldwide now routinely carry digital cameras with inbuilt communications and positioning capabilities with them wherever they go. This offers great potential to create experiences that involve the capture of images from the physical world and their transmission to other players. Several recent projects have explored this approach including the Nokia Camera Phone Game (2006) in which players' hunt and then 'shoot' other players by taking their photographs and StickyShadows™ which allows users to share pictures by placing virtual sticky notes in geo-tagged locations.

With mobile technology, learning can take place in many different locations and does not require learners and teachers to be in the same place at the same time or even be confined to a classroom at all. Several projects have explored how the learners' physical location can be used in gaming and learning experiences and how mobile technology can situate conversational learning in the meaningful context of its location, with learners sharing perspectives about their world and its artefacts (e.g. Flintham, et. al. 2003; Sutch, 2005). Such location-based experiences may be seen as fun, but without serious implications for learning. However, it can be argued that if the primary purpose of education is "to enable children to understand, control and ultimately change their environments", then the city itself us must be mobilised as a learning resource (Ward, 1978). Our location and environment is not simply an additional context to learning, but could ultimately be one of the most significant aspects of how we come to understand and operate with each other and within our world.

This paper introduces a prototype for a locative social game called MobiMissions that set out to explore how mobile camera phones with location-based services could support new experiences that engage players with the physical world and each other. In MobiMissions, players use their camera phones to create missions for other players who then use their phones to respond to these missions. We provide an overview of its design and implementation and summarise feedback from early trials. Finally, we look forward to future possibilities for using these kinds of location-based social experiences to support learning.

2 Cellular Technology

The location system on which MobiMissions is based on Cell-IDs used in the mobile phone network. The mobile phone network divides the whole country up in cells that are each served by one antenna. The size of cells varies from a few hundred meters in cities to several kilometres in rural areas. The reason for this is that all users in a cell share the same frequency and bandwidth. This means that the number of simultaneous calls in a cell is limited. The GSM networks support up to 8 calls in a single cell at the same time. Because the number of simultaneous calls depends on the number of people in the cell the size in less densely populated areas can be a lot larger then in cities. To complicate matters further from a location systems point of view, cells don't occupy their own space but overlap greatly so users can switch between cells without losing their connection. This means that in

one location there maybe a few cells with different IDs (see Figure 1). The different mobile phone operators sometimes share towers where they place their antennas but they never share antennas. This means that the cell-IDs of different operators are always distinct in any location. Because we only used one operator in this trial this wasn't a problem.
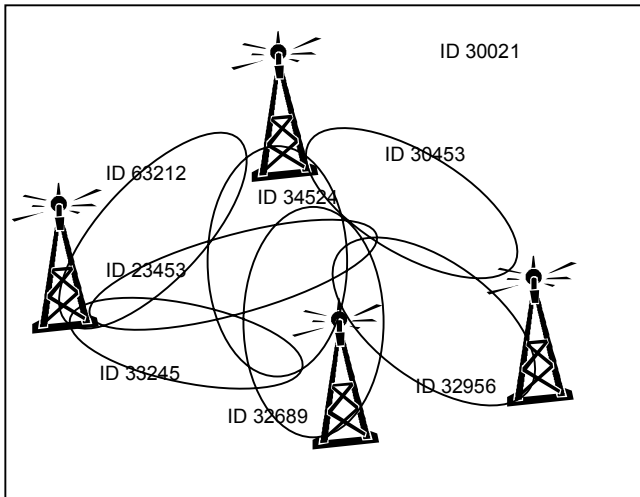
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Figure 1: overlapping cells

3   Origination of idea

The project originated through Futurelab's 'Call for Ideas', which establishes partnerships and provides funding and support to develop innovative ideas for supporting learning using digital technology.

The Mixed Reality Lab at Nottingham University had developed a locative and mobile game exploiting cell-ID positioning to be played on mobile phones called 'Hitchers' (Drozd, et al 2006). This involved creating virtual hitchhikers on a mobile phone, giving them a name, a destination and a question, and then releasing them into the player's current cell where they would remain until picked up on another player's phone and from there carried to other locations.

4   Participatory design process

MobiMissions emerged from a process of participatory design in which designers, technologists and potential players worked together to explore and generate game designs.

Young people aged 16-18 were identified as our target user group, as they are independent enough to move around the city on their own, and therefore able to take advantage of the mobile potential of this technology. Informant design workshops were held with a group of 12 young people from a post-16 centre in Bristol, UK, to explore ideas around mobile phones and location-based and collaborative experiences, and to generate possibilities and requirements for a new experience based on the Hitchers technology. Low-fi prototyping sessions were held with these same participants to inform the subsequent detailed design and realisation of a game that we called 'MobiMissions'.

5   The MobiMissions game

MobiMissions is based on the concept of creating and responding to missions using a mobile cameraphone. Each mission is defined by up to five photographs and/or five sections of text. The content and purpose of missions is left open-ended for players to define for themselves.

5.1   Creating missions

A player creates a mission by using their phone to take a series of photographs and enter sections of text and then 'drop' the mission from their phone. The mission remains at the location where it was dropped until it is found and picked up by another player.

Location is defined by the mobile phone cell to which the player's phone was connected when they dropped the mission. Whenever a player drops a mission they are prompted to describe their current location through a short text phrase, giving a clue to other players as to where to find it.

Figure 2: Creating a mission

5.2   Searching for missions

Players can search their current location (mobile phone cell) whenever they want to find a mission to respond to. They see the names of missions that are present in their current cell with a short text description. In order to ensure that players always see something in response to a search, if there are less than three missions in their current cell the system also returns up to ten missions from a pool of 'floating' missions that have been created by the game's designers to be location-independent (i.e. playable anywhere).

The player can then chose to pick up one or more missions at which point it is transferred to their phone and no longer available to other players until such times as they drop it again. A player can only carry a limited number of missions at any time (this was set to three for the trials).

5.3   Completing missions and uploading responses

The player can see full mission details – the series of up to five images and/or text sections – for the missions that they are carrying on their phone. Players respond to missions by capturing up to five photographs and adding up to five short text annotations. They can save their progress mid-response in order to complete at a later time if necessary. When their response is complete, they submit it to the system which causes their response to be uploaded to the game server and the mission to be dropped from their phone. They are prompted for their current location as described previously, and the mission remains in their current cell until picked up by another player. The player are asked to rate how good the mission was on a three point scale (0 to 2). In order to reflect the likelihood of collaboration amongst players, they are also asked whether they completed the mission with any other players and asked to give their names. Players can of course

choose to drop missions even if they have not completed them, for example, if they have found a more interesting mission to carry with them instead.

5.4 Rating missions and responses on the website

The mobile game is supported by a website which allows players to view and search all missions and responses, see a mission's current location (the text label supplied by the player who last dropped the mission) and to see whether and how a mission has been completed by other players. Players can also maintain personal profiles on the website, uploading a personal photo and text description. Players can also leave comments on one another's profile, or on specific missions or responses. The website enables players to rate other players' responses to a mission also using the three point (0 to 2) scale.

5.5 Scoring

Players earn points by creating and responding to missions, with more points given for creating missions, as that was seen as a more time-consuming and difficult task. Each time a mission that they created is responded to, the player earns a further point. A respondent's rating of the mission is also added to its creator's score and ratings of responses are similarly added to the respondent's score.

6 Ethics and moderation

Mobile and location-based games involving young people raise a specific set of ethical questions around access to personal information including location, personal photos and phone number. Sharing and display of potentially inappropriate images on a website also raises ethical considerations. These were addressed during the trials in the following ways:

Players could not discover each others' phone numbers by participating in MobiMissions. While players gave their location when they created or submitted missions, there was no way of discovering exactly where they were at any particular time. The cell IDs of all interactions were visible to the administrators of the game, but there was no precise way of matching cell ID to specific location, and this information was only recorded at specific times when the participant was interacting with the central server hosting the game, not constantly throughout the day.

Players could leave public messages for one another on the website, but could not contact one another directly by phone. The website was only viewable by the participants within the trial, who were issued with usernames and passwords, in order to protect their privacy by preventing people from outside the trial leaving them messages or viewing their information.

Missions, responses and comments were posted on the website and available within the game as soon as they were created, in order to foster a sense of immediacy within the game. However, all new content was reviewed by administrators daily for the purposes of moderation. In addition, players were able to report any mission, response or comment as being offensive at which point it was blocked from view from all players until the moderators had reviewed it.

7 Notes on the implementation of MobiMissions

The phone application was built using J2ME, a minimal java implementation for lightweight devices such as mobile phones. Sun's Java Wireless Toolkit was used in the development process to build and debug the phone application. Data held by the phone (e.g. current missions and draft missions and responses) is stored in a shared dataspace that is maintained by the Equip2 platform from the Mixed Reality Laboratory. Persistence is provided by a relational database running on the mobile phone. The phone state is synchronised with the game server when the user interacts with the game.

J2ME does not allow access to the phone's current cell ID. Therefore, a third party application called PlaceLab was used to access cell ID information. The interaction between the J2ME phone app and PlaceLab is via a local socket call.

Interaction between the mobile phone client and the game server is via HTTP over a GPRS connection. The mobile phone client and game server communicate using a binary encoded message passing system in order to minimise the bandwidth required and hence the cost of playing.

The game server also uses Equip2 to store and query all game data. Server side persistence of the Equip2 dataspace is provided by MySQL, a relational database management system. Hibernate is used to link Equip2 with MySQL, providing an object to relation mapping. The server side application is built using the Spring Framework, a J2EE implementation. The MobiMissions game server is built using the Model View Controller model. JSP pages are used to provide the web interface. Custom J2EE controllers used to provide the game logic. Requests to the game server are dispatched to the appropriate server class (the controller) which retrieves and updates the game state. Required information is then passed to the appropriate JSP page (the view) via a data holder class (the model). This allows the web interface to be developed separately to the game logic. Future changes to the game logic or web interface then have less impact on each other, reducing the development and maintenance costs.

8 Findings from trials

The key aim of our early trials was to explore significant factors affecting young people's participation in this kind of locative and communicative mobile phone experience, in order to start to understand the potential of these kinds of technology to support new ways of learning, rather than simply reproducing existing models of content delivery through a new channel.

MobiMissions was played over five weeks in October and November 2006 by a group of 11 volunteers aged between 16 and 18 years, including several who had been involved in the development and design of the prototype. They were recruited from a Post-16 Centre in Bristol, and played outside lesson time.

A multi method approach to data collection was taken in order to build up a rich picture of the use of the game, from detailed interrogation of participants' own understandings to quantitative data giving an overview of the patterns of use. Qualitative data included the text and visual content of missions and responses. In addition, six participants assisted in data collection and analysis, completing weekly diaries of use, peer interviews in which players interviewed other players, and weekly group interviews with a project researcher. Quantitative data included the time, date, username and type of action for all interactions between phone and server, as well as the user-supplied location label and cell ID for all mission drop actions.

8.1 Overview of game use

Figure 3 shows the number of missions and responses made by each of the eleven players over the five weeks. Overall, nearly twice as many responses and missions were created, with 123 responses and only 73 missions created. Only one player made fewer responses than missions, and this player hardly played at all, making only one mission.
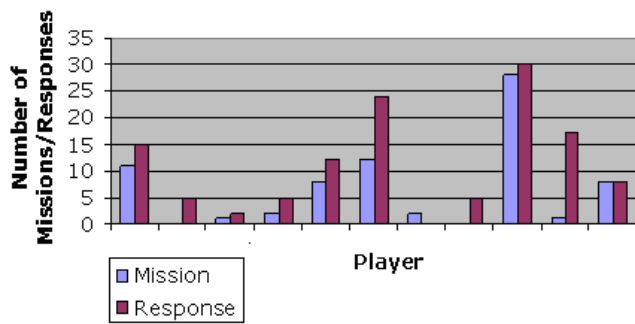
Figure 3: numbers of missions and responses per player

Of the 73 missions that players made, only 31 (42%) were responded to by anyone other than the author of the mission. This means that a relatively few number of missions attracted a good deal of the responses. The group of missions that had most responses included those 'floating' missions that were not fixed to a specific location. These would have been among the most frequently found missions. Missions that were dropped off in highly frequented locations such as at the participants' college also received more responses. Indeed, of the thirteen missions with three or more responses, five were floating missions, a further three were located at college, and another two in local pubs and cafes.

Over the course of the trial, players' participation fluctuated. Some played sporadically throughout, while others participated less frequently towards the end, while four others joined after the start of the trials. There does not appear to be an obvious trend toward play either increasing or decreasing over time.

8.2 Local co-located play

In focus group interviews and diaries, players reported that they preferred playing with others, at the same time and in the same place, as compared to playing on their own. This co-located play usually involved players engaging with the game through one phone and one player's account, rather than each player simultaneously playing on their own phone, exemplifying the easy and natural sharing of phones and content amongst teenagers that has been observed by previous studies of teenage mobile phone users as reported by Weilenmann and Larsson [20].

Students found this co-located play to be more inspiring than playing alone. In the words of one: "You get better ideas". Co-located play tended to take place amongst groups of existing friends, and they also reported it to be more fun, observing that: "You can have a laugh." Indeed three of the most frequent players in the game were friends who often played with one another, supporting the suggestion that co-located play was more motivating than playing alone.

We also observed that co-located play took place in the times and places where our participants already gathered to socialise with each other, and so it can also be seen as an example of how new technological practices are articulated and negotiated through existing local patterns of sociality as discussed in Yoon [21].

8.3 Asynchronous social play

However, social play did not so readily extend to the asynchronous exchange of missions and responses. As noted previously, many missions were not responded to by anyone other than the mission's author, and players reported disappointment at the lack of response to their creations. One player in a group interview described the lack of responses as "demoralising", a feeling that was shared by others.

One reason for this lack of reciprocity in asynchronous play was that when players found a mission, they could not immediately discern who had made it and without the social context supplied by knowing who missions were created by or who they were intended for, there was no compelling social reason to respond. This is illustrated by one occasion when a player picked up a mission and, with pleasure, recognised her friend's 'style' of writing. While she still did not choose to reply to it, it did spark a subsequent offline conversation between them, acknowledging and reciprocating in a way that reaffirmed their knowledge of one another and reinforcing their social ties. However, because most players did not know who they were responding to, they felt little social obligation to reciprocate to missions.

8.4 The content and value of missions

One student, who played mostly at home when alone, put a lot of effort into making missions. She perceived her missions as having 'high value' because of their interesting content, reflecting the thought and time she had invested, for example the following mission:

Figure 4: screenshot of a 'high value' mission

Other players also noted the value of this player's missions, for example commenting, "she's been thinking".However, this player became frustrated by the lack of reciprocation. When another player eventually found and responded to one of her missions, she reciprocated by leaving a message on the website to thank him and comment on his response, suggesting a strong desire for greater reciprocity.

Players also commented on the 'low value' of some missions, that were seen as taking little time or effort to make and being 'boring', for example a mission that showed a picture of a cigarette lighter with the question "what is this?". Such missions were regarded as too low value to be worthy of reciprocation.

The emerging etiquette of the game suggested that the majority of players felt it was more important to create interesting missions, rather than simply create as many as possible in order to earn points. Players generally felt there was a lack of interesting missions for them to respond to, and this relative scarcity may partly explain why interesting missions were seen as so valuable. However, creating interesting missions was difficult and required significant time and effort, which players were not often prepared to spend, particularly when playing alone and particularly when perceiving that their efforts were going unacknowledged.

8.5 The locations of play

Figure 5 shows the frequency of locations for play from players' location descriptions when they dropped missions from their

phones. This pie chart suggests that most play took place at home, with 58% of all user-tagged locations being either 'home' or 'bedroom', often when players were alone and often late at night.
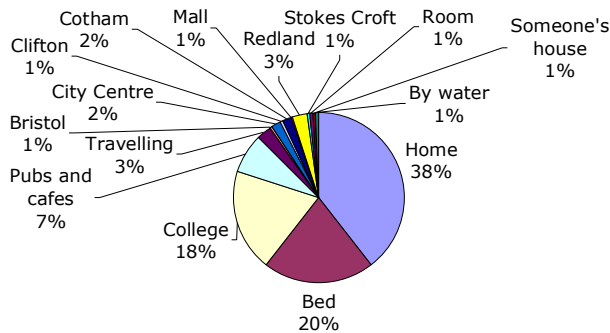

Figure 5: the popularity of different locations for play

The reasons players gave for playing at home usually related to time. Late at night, at home, was when they felt they had spare time, free from homework, college, part-time jobs and other social activities. This relates to findings suggesting that much of young people's media use in the home is in response to boredom, with media being engaged with when other activities such as going outside with friends are not available (Livingstone, 2002).

Missions created and dropped off in the players' homes were less likely to be picked up, because other players were unlikely to find themselves in that cell. Therefore, this solitary play at home was doubly isolating because not only were players alone at the time of play, but the chances of asynchronous reciprocation were also diminished. However and in contrast, as discussed above, co-located play tended to take place in locations where people gather socially and where missions therefore had a greater chance of being found by other players. The location of play therefore was a significant factor in communication and reciprocity, both in co-located and asynchronous play.

Figure 5 also suggests that play was restricted to a relatively limited range of locations, with 83% of play taking place in just three kinds of locations (Home/Bedroom, College and Pubs/Cafes). This was confirmed in focus group interviews, with one student reporting: "you're in the same environment every day […] you don't go anywhere new". Young people this age are perhaps not the highly mobile people we might imagine them to be, at least not on a regular basis.

It also appears that players did not play in a highly 'mobile' way. Rather than dipping into and out of the game throughout the day as they moved around, they tended to play in focused sessions at very specific times and places: with friends in cafes during the day and alone, at home in the evenings. This means that missions are unlikely to have moved a great deal, and so would not necessarily have reached a very wide potential audience. Indeed, players complained that they saw the same missions in the same locations over and over again. Participants remarked that they would use the website to look at missions that they could never find on their phones, because they didn't go to the locations where these missions were to be found, such as other players' homes.

Location tended to be used in an opportunistic way, as a source of inspiration for content rather than being used particularly strategically. For example, players did not consider where they would leave their mission in order to maximise the number of people who might respond to it, leave missions in

locations relevant to their content, or that required people to go to certain locations in order to respond effectively.

However, location was significant for providing inspiration for mission content, with players searching their environment for an image on which to base a mission, for example the following mission of a household ornament:

Figure 6: Mission showing a household ornament

This suggests that a game such as MobiMissions has the potential to support players sharing their perspectives on a particular place, and utilising their environment as a resource for creating content.

8.6 The role of the website

Players had to check the website to see if their missions had attracted any responses, and would have preferred responses to be sent directly and immediately to their phone. For example, one player felt that after creating a mission: "it goes into cyberspace", expressing the feeling that he had no connection with it after that point. It is notable that this group of players were not familiar with holding social conversations asynchronously via email. Email was seen as a purely formal channel, whereas social conversation was held through immediate channels of voice calls, text conversations, Instant Messaging, or face to face, so it may be that they expected more synchronous, immediate communication in extended social conversations. Furthermore, their relationship with mobile phones up to this point would be largely as a tool for direct communication with a particular recipient, and expecting a relatively swift response. The use of a phone may in some ways have encouraged false expectations about the nature of communication in the game.

Also, because responses were only shown on the website, players did not immediately know whether and how others had responded to missions they had made or were considering responding to. This made for repetition between responses as many players submitted similar responses to the same mission.

8.7 Competitive game or social exchange?

In the initial informant-design workshops, the idea of creating a competitive game appealed strongly to some participants, while others preferred the idea of a more casual experience based upon an informal network of exchange. These two approaches to MobiMissions emerged as a source of tension for how players chose to interact with the game and one another during the trials.

The scoring system had been intended to encourage play, and to enable players to judge how well they were doing in the game. The system awarded some points automatically for any play, regardless of quality, but players were also able to rate the

quality of a mission or response, which was intended to bring a qualitative element to the scoring.

However, in practice, players did not use the ratings system in this way. Players gave ratings to missions that they completed on their phones, because they had to do this as part of the process of submitting their response. However, rating responses was optional, and only possible on the website with the effect that nobody chose to do this. Some participants reported that they did not see MobiMissions as a competitive game and were therefore not interested in rating content. Instead, they were more interested in creating and responding to missions that they found intrinsically interesting, and in getting feedback from other players in the form of comments or through responses themselves, rather than playing for points.

A minority of players however were motivated by accumulating points and used the system to create and respond to their own missions, rating them highly in order to maximise their score. Because these missions were not created with an audience in mind, they were often rather mundane, and were criticised by those players who had focused on creating 'interesting' missions to share.

The emerging consensus amongst the majority of players was that creating 'interesting' missions, in which the motivation to complete them was intrinsic to the content of the mission, was more motivating and valued more highly than scoring points by any means available. For most players, the points reward was thus extrinsic to the emergent game goal of creating interesting missions, meaning that the points were not a motivating feature.

9 Future Possibilities

One of the aims of the MobiMissions prototype project was to project forwards to future possibilities for using such technologies to support learning.

In workshops with young people, teachers, technologists and educationalists, and drawing on the broader theoretical and practical context, several avenues for future applications of the technology and for new research angles were generated, which are summarised below.

9.1 Site-specific applications

An activity such as MobiMissions could be used to develop a way of interacting with location, content and other visitors in theme parks, museums and historical sites. Focusing the experience on a defined location, or set of linked locations, may focus the interactions between people and location/content in a more intense way in places such as historical battle sites, stately homes, theme parks, zoos, cities' cultural quarters and national parks. Opportunities also open up for exploring less formalised spaces such as the parks and open spaces closer to home, 'secret histories' of urban areas and locations for participating in outdoor activities such as skateboarding, football parks, surfing, etc.

Professionally-scripted Missions could support immediate game-like activities, whilst visitors' creations and responses could build up over time to become an aggregated repository of reactions, responses and additions to information located in specific sites. Older

Creating and responding to Missions could be a way to get more out of return visits to the same site, making each visit unique depending on the activities of recent and simultaneous visitors. Consideration would need to be given to if and how people would access information about the location before and after their physical visits, and to the tensions between synchronous and asynchronous communication, providing immediacy to the experience yet also benefiting from the range of responses accumulated over time.

Taking advantage of mobility as much as locatedness, MobiMissions could act as a kind of 'armchair traveller', with creators collecting tales of a journey as Missions send back information gathered from different travellers. Acting as a traveller's informal journey companion, Missions could provide up-to-date and 'from-the-field' information about things to do and see from people on similar routes.

9.2 School

In field trips, an activity such as MobiMission could meaningfully link the location where data is gathered with later analysis. Over time, a school knowledge base could be compiled, tracking changes over time. The exchange of Missions about specific locations could link activities between those participating in a field trip and other learners participating in complementary activities back in the classroom.

The discovery and exchange of located content in particular areas could be developed into a way of linking a school more closely to its local community, through the sharing of ideas and images. Discovering and mapping the learning and knowledge resources already present in local communities could be approached through the located exchange of images and information.

If content could be 'sent' as well as 'found' then exchanging information and perspectives between different countries could be a way of building partnerships between different schools as learners developed ways of representing themselves and their ideas to other young people with very different ideas and perspectives.

9.3 Located social networks

Supporting greater social communication may enable an experience similar to MobiMissions to develop into a located social network site similar to the websites such as MySpace or mobile, located social services such as StickyShadow™. Interactions could be aggregated to build up a social map, displaying individuals' movements and favourite locations, and showing how individuals' maps might intersect with maps of friends, and the maps of the wider community. The intersections between geographical and social maps could perhaps even help to provide useful forums for developing greater communication within communities.

9.4 Shared interest groups

Implementing an experience based on MobiMissions with defined interest groups may provide a focus for and purpose to the content of exchanges. For example, naturalists could share information about the location of wildlife, local historians could build up an interconnected network of information and memories of an area rich in history, or environmentalists could mobilise community resources and debating what action to take to fight pollution and neglect in particular locations.

9.5 Games

Gaming applications could be developed further with similar technology and experiences. Exploiting the located and mobile affordances of the technology, the cityscape can be transformed into a giant game board.

Strategic and territorial games such as Risk could be played out as players lay claim to particular cells by creating content, or appropriating content created by other players. Interactions such as these linking real and virtual locations could lead players to new explorations of their surrounding areas.

Viral games could also be distributed through use of MobiMissions technology. For example, players could create Missions or other content that could reproduce and spread throughout the player population, perhaps communicating

marketing information or other networking information. Conversely, viral distribution may also be a way of collecting information, for example the 'mood' of players, which could be displayed and communicate to the group as a whole.

In summary then, this discussion tentatively points towards some of the ways in which MobiMissions might be extended or redesigned in the future, particularly the potential to transform the experience into a more socially propagated and supported game that would be of interest to this particular group of users. Evaluating such extensions as well as exploring other potential applications of MobiMissions should be the focus of future research.

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