Designing to Support Impression Management

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Abstract

This work investigates impression management and in particular impression management using ubiquitous technology. Generally impression management is the process through which people try to influence the impressions that others have about them. In particular, impression management focuses on the flow of information between a performer and his/her audience, with control over what is presented to whom being of the utmost importance when trying to create the appropriate impression.

Ubiquitous technology has provided opportunities for individuals to present themselves to others. However, the disconnection between presenter and audience over both time and space can result in individuals being misrepresented. This thesis outlines two important areas when trying to control the impression one gives namely, hiding and revealing, and accountability. By exploring these two themes the continuous evolution and dynamic nature of controlling the impression one gives is explored. While this ongoing adaptation is recognised by designers they do not always create technology that is sufficiently dynamic to support this process. As a result, this work attempts to answer three research questions:

RQ1: How do users of ubicomp systems appropriate recorded data from their everyday activity and make it into a resource for expressing themselves to others in ways that are dynamically tailored to their ongoing social context and audience?
RQ2: What technology can be built to support ubicomp system developers to design and develop systems to support appropriation as a central part of a useful or enjoyable user experience?
RQ3: What software architectures best suit this type of appropriated interaction and developers' designing to support such interaction?

Through a thorough review of existing literature, and the extensive study of several large ubicomp systems, the issues when presenting oneself through technology are identified. The main issues identified are hiding and revealing, and accountability. These are built into a framework that acts as a reference for designers wishing to support impression management. An architecture for supporting impression management has also been developed that conforms to this framework and its evolution is documented later in the thesis. A demonstration of this architecture in a multi-player mobile experience is subsequently presented.

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Acknowledgements

Since my research has been conducted within the Equator group, I have been fortunate to work closely with many excellent and well-respected researchers during my time as a Ph.D student. I would like to thank all of those who have contributed to the various projects presented in this thesis.

Throughout the thesis the individuals who have worked on each project is explicitly stated, with the majority of my work being conducted with my colleagues at the University of Glasgow, and I would like to thank all of them for their commitment and dedication during each of the projects the author has worked on.

I would also like to particularly thank Marek Bell and Malcolm Hall with whom most of the work in this thesis was developed. I would also like to thank Barry Brown, for his advice and guidance during my research and for always making time to offer this advice when I needed it. I would also like to thank the other members of the group who have helped along the way, namely Julie Maitland, Stuart Reeves, Louise Barkhuus and Donny McMillan. These people have not only been determined and inspirational colleagues but also valued friends.

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Declaration

The contents of this thesis are the author's personal work. However, many of the systems discussed within this thesis have been designed and implemented as part of the Equator group at the University of Glasgow and have been accomplished, in part, with contributions from others in the Equator IRC.

The author has attempted to make clear when and by whom systems have been designed and implemented with others. However, the author has been one of the main designers and programmers of every system developed by the University of Glasgow Equator group, with the exception of the Lighthouse and main George Square system although he did design and implement the George Square Blog. Specifically the, author was the main designer, programmer and evaluator of *Egor* and *Ego* and part of a group of designers, programmers and evaluators of *Treasure*, *Feeding Yoshi*, *Castles*, *Shakra* and *Connecto*. The *Domino* architecture presented in Section 6.4 was primarily the work of Malcolm Hall although the author did contribute to later modifications needed for its use within the Castles game.

List of Publications

The following is a list of publications for which the author has been either a primary author or a co- author, and which are related to, or have influenced, the work in this thesis.

Sherwood, S., Reeves, S., Maitland, J., Morrison, A. and Chalmers, M. *Adapting Evaluation to Study Behaviour in Context*, To appear in Intl. J. Mobile Human-Computer Interaction.

Barkhuus, L., Brown, B., Bell, M., Sherwood, S., Hall, M. and Chalmers, M. *From awareness to repartee: sharing location within social groups*, Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems, ACM, Florence, Italy, 2008, 497-506.

Sherwood, S., Maitland, J. and Chalmers, M. *Problems of space and time: learning from the experience of studying ubicomp use in the wild,* Interact 2007 Workshop: Usability in the Wild, Rio de Janeiro, Brazil, 2007.

Anderson, I., Maitland, J., Sherwood, S., Barkhuus, L., Chalmers, M., Hall, M., Brown, B. and Muller, H. *Shakra: tracking and sharing daily activity levels with unaugmented mobile phones,* Mob. Netw. Appl., 12 (2-3). 185-199, 2006.

Maitland, J., Sherwood, S., Barkhuus, L.A., I. Hall, M., Brown, B., Chalmers, M. and Muller, H. *Increasing the Awareness of Daily Activity Levels with Pervasive Computing,* Pervasive Health, Innsbruck, 2006.

Bell, M., Chalmers, M., Barkhuus, L., Hall, M., Sherwood, S., Tennent, P., Brown, B., Rowland, D., Benford, S., Capra, M. and Hampshire, A. *Interweaving Mobile Games with Everyday Life*, Proceedings of the SIGCHI conference on Human Factors in computing systems (CHI), Montreal, 2006, 417-426.

Barkhuus, L., Chalmers, M., Tennent, P., Bell, M., Hall, M., Sherwood, S. and Brown, B., *Picking Pockets on the Lawn: The development of Tactics and Strategies in a Mobile Game*, In Proceedings of the 7th International Conference on Ubiquitous Computing, (Tokyo, 2005), Springer, 358-374.

Chalmers, M., Bell, M., Brown, B., Hall, M., Sherwood, S. and Tennent, P. *Gaming on the Edge: Using Seams in ubicomp Games,* ACE, Valencia, Spain, 2005.

Chalmers, M., Bell, M., Brown, B., Hall, M., Sherwood, S. and Tennent, P. *Gaming on the Edge: Using Seams in Pervasive Games,* PerGames 2nd International Workshop on Pervasive Gaming Applications, 2005.

Tennent, P., Hall, M., Brown, B., Chalmers, M. and Sherwood, S. *Three Applications for Mobile Epidemic Algorithms,* MobileHCI, Salzburg, Austria, 2005.

Brown, B. and Sherwood, S. *Designing positional goods*, HCI 2005 workshop on Understanding and Designing for Aesthetic Experience, 2005.

Chapter 1 Introduction

Impression management is an ongoing social process, often done subconsciously by individuals as the go about their everyday lives. Technology offers new channels, through which individuals can present themselves to others, for example the Internet has given individuals a domain in which they can present themselves to a much wider audience. The ubiquity of mobile technologies has reduced the cost of recording one's activity and therefore increased the likelihood that everyday activity can be brought into these presentations. This thesis presents several studies of mobile systems from a variety of domains including, tourism, health, and games, from which two main topics concerning impression management are discussed.

With our increasing use of online games, social networking sites, blogs and personal websites, the need to present oneself in an appropriate way is becoming greater while at the same time becoming increasingly more difficult. The transient localised nature of information presented in face-to-face communication is very important to impression management. However, digital technologies used to present oneself such as social networking sites, make information permanent and globally available. This introduces challenges for those wishing to control the way in which they present themselves through these technologies.

By making use of increasingly pervasive technology designers can provide users with the ability to dynamically create content and tailor it based on an individual's current context. The work in this thesis combines several different areas including ubiquitous computing, context, awareness and collaboration, play and games, and impression management. Each of these areas will be briefly discussed before the research questions are outlined.

1.1 Origins of Ubiquitous Computing

Computing devices are becoming ubiquitous in our everyday lives. Nowadays, computers can be built into almost everything. There are computers in your car, in your mobile phone, in children's toys; computers are even being embedded into furniture. Many of our everyday household appliances also have small computers hidden inside them called microcontrollers. These microcontrollers provide limited computational power so that they can control features or actions of an appliance. For example, the microcontroller inside a TV takes input from the remote control and displays output on the TV screen. Such

technology resides in all of our everyday lives, receding into the background, leaving us almost unaware of its existence.

Ubiquitous computing is a term coined by Mark Weiser in 1988, with the goal of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user [135]. By augmenting the world in this way, the hope is to move the attention of users away from the devices they are using and back to the tasks being undertaken. Weiser's notion of ubiquitous computing acknowledges not only situated action [125] and setting computer applications in the context of the user, but also that individuals primarily work and interact in a world made up of shared experiences and social interaction.

Between 1970 and Weiser's conception of ubiquitous computing in 1988, human computer interaction had largely taken a narrow focus on the window paradigm developed at Xerox PARC. To achieve his vision of ubiquitous computing, Weiser incorporated several existing projects such as the wall-sized pen board called LiveBoard, the inch–sized tab and the foot–sized pad, to create a set of devices that could be ubiquitously integrated into everyday life. This strategy was known as computing by "*the inch, the foot and the yard*" [135]. As Weiser pointed out, looking around a typical room there are several writing and display surfaces that fall into one of these three categories. At the inch scale there are post-it notes, labels on controls and badges. At the foot scale, there are items such as books and wall hangings. Pads were intended to be "scrap computers" that could be used anywhere with no individual identity or importance, similar to our use of paper. Finally at the yard scale, there are white boards in offices and billboards in the streets. Depending on the size of the space there may be thousands of possible devices fitting into one of these three categories. Although this perspective does not address auditory and other non–graphical media, the view of dynamically changing ensembles of communicating devices was revolutionary.

To produce a truly ubiquitous experience many of these devices—including those owned and directly used by people as well as those that they indirectly interact with, must be linked together. A wired network, for example the Internet, can be used to connect these devices however this results in restricted mobility. Devices may be connected using wireless networks and therefore increase mobility, although problems can exist such as network coverage being restricted, reducing bandwidth or connectivity. For many mobile

applications, limited coverage of wireless networking technologies and positioning systems proves to cause large problems. These issues are discussed later in the thesis and their implications for strategies for designing technologies and studying users are highlighted.

1.2 Context, Awareness and Collaboration

In Ubicomp there are two common perspectives of context that are designed for: the systems perspective, and the users' perspective. Those who design to take account of context at a system level often aim to provided systems that react and adapt to the environment that the systems are found in. Much of the earlier work in CSCW highlighted the importance of the social interaction that surrounds given tasks and how ignoring this can prove to be problematic [113]. The work presented in this thesis takes aspects of both approaches, enabling systems to react to a change in context, while also enabling users to drive this process through context awareness tools that expose aspects of the current situation.

The need to set computing applications within a given context and understanding that they exist in a world of shared experiences and social interaction is extremely important to the work in this thesis. Placing work in its given context is paramount to its successful adoption by its protective user group [97]. It is this context that provides individuals with a reference frame from which to conduct any collaborative work or understanding of systems capabilities. Not only does this understanding help when problems arise, it also gives users the freedom to use technology in new and unforeseen ways. For example, an understanding of the mobile phone network built up through experience gives users valid if not necessarily truthful reasons such as poor signal strength, for cutting short a call.

Often in computer-mediated communication, designers try to hide as much of the underlying infrastructure away from users, therefore acquiring such information is problematic which in turn prevents informed decisions from being made. Instead, to achieve a sufficient level of appropriation systems must expose how they work, rather than a traditional black box approach where the underlying workings are hidden away. Also evaluators should look to extended trials where users can become familiar with a system and the different contexts in which it might be used can be explored. By doing this we

enable people to build up their understanding through negotiation with peers, enabling re-evaluation and adaptation of an individuals understanding if necessary.

By making users more aware of system behaviour and how it uses the surroundings within which it finds itself, and making systems represent more of their own use and context we can enable both users and systems to adapt and change. Even with the most naïve models systems can adapt and change depending on the context within which they find themselves. Also, if we provide sufficient feedback and control mechanisms users can monitor and adapt the system's behaviour themselves. We must not forget that understanding is also shared. Through their discussions with others, users can manipulate common understandings to their benefit as can be seen with the previous mobile phone example. In this particular example understanding, interpreting and changing information is formally governed by a strict set of system constraints. However, this is mediated and manipulated by the conversation between participants. This is what Robinson [114] terms "double level language". This continuous negotiation and reinterpretation is extremely important and is highly contextually dependent.

This double level language is extremely important in supporting our understanding of the world and others we interact with. Computer supported collaborative work (CSCW) has been an area where this combination of the social aspects that surround any activity along with the formalised procedures that are a necessary part of the computer systems we use has been studied in depth [78, 79, 124]. The level of transparency advocated by Weiser enables this type of interaction with individuals no longer required to focus on the tools they use, instead focussing on the task at hand. From CSCW and into ubiquitous computing the understanding that the social world is tightly coupled to any applications we create as designers has expanded both research areas to include topics such as leisure and playfulness.

While there are many definitions of context that will be discussed in Section 2.1.3 the definition of context that the thesis builds upon is that of Dey and Abowd [35]:

> *"[A]ny information that can be used to characterize the situation of entities that are considered relevant to the interaction between a user and an application, including the user and the application themselves".*

More specifically the elements that they define as important features of context, location, identity and state of people, groups and computational and physical objects, are carefully considered and often supported in much of the work presented.

1.3 Play and Games

As has been mentioned, by designing for appropriated behaviour individuals are able to use systems in unforeseen ways. Often this results in playful activity such as competition added by the players themselves and maintained through their banter with one another. Play is something that is very important as it allows us to build up our understanding of the world around us. Koster [91] points out the important role that games and play have in our development as socialised beings:

> *"Playing "house" is about jockeying for social status. It is richly multileveled, as kids position themselves in authority or not over other kids"*

Often games and play are not taken very seriously. However, in recent years, games have become big business. The computer games industry has become a multi-billion pound industry rivalling both the music and the film industries. A good deal of traditional game play is based around social interaction, with the coming together of friends and family to play and interact with one another. In recent years, the computer games industry seems to have realised the importance—or perhaps just the commercial feasibility—of a shared experience, resulting in many massively multiplayer online gaming communities such as X-Box Live. These however, still lack the richness of face–to–face interaction.

Ubiquitous gaming offers us the opportunity to integrate into our computer gaming applications more of the social aspects extremely important to traditional gaming. Also, computer gaming need no longer be confined to the home; instead it can be taken out and played in the street, on a bus or anywhere we choose. Games have long been one of the most popular applications of technology, both in terms of their impact on culture and also in terms of their financial success. It is therefore reasonable to accept that games have a role in research. For example, games have been a key motivator for the development of new technologies and techniques, in particular graphics and AI. The fluid and playful interactions that games engender are promising ground for exploring concepts which would be harder to develop or justify in more work or office–based applications.

Games are thus of interest not only for their status as games in themselves, but as environments for experimenting with concepts of general interest. There are several research projects that have used outdoor gaming as a means of exploring new research ideas. 'Can You See Me Now' (CYSMN) linked both online and street players in a game of chase [9, 30]. On-line and street players shared the same physical area (a set of city streets), with on-line players using arrow keys to move themselves around a 3D view of the area, and street players' movements in the area tracked by GPS. Street players chase on-line players through the city attempting to catch them, with caught on-line players taken out of the game. In playing CYSMN, some of the inherent problems with mobile applications mentioned above were encountered. For example, GPS inaccuracy caused problems for street players when trying to catch players in areas with bad GPS coverage. However, as the game progressed, street players became more skilled at using their GPS inaccuracy to 'ambush' online players – lurking in areas of bad GPS and then running into areas of good GPS so as to surprise online players. In this way, the street players were able to exploit the seam between the smooth functioning and the realization that there is technology beneath. In ubicomp gaming, we can expect such 'seams' to persist, and design that takes account or that takes advantage of such seams—seamful design [23] [25]—is a novel yet pragmatic response to this fact. This thesis includes work on seamful design, in particular games, as discussed in Sections A.2, A.3, and A.4.

1.4 Impression Management

With the technology that is readily available today such as the Internet, mobile phones, GPS systems and many more gadgets there is little wonder that people are finding new and unforeseen ways to use these systems. Often playful characteristics are displayed in these new appropriations (see Section A.5). The rise of social networking sites has been meteoric, when presenting oneself to others, every aspect is scrutinised and evaluated before it is used in any type of self-representation. This is in keeping with how we adapt our self-presentations throughout our everyday lives to invoke specific responses from others, with the aim of influencing others perception of them. In Goffman's [68] words,

> *"When an individual enters the presence of others, they commonly seek to acquire information about him or to bring into play information about him already possessed. They will be interested in his general socio-economic status, his conception of self, his attitude towards them, his competence, his trustworthiness,"*

Looking away from computing for the moment we can see shared understanding and appropriated use of all kinds of things in our society. For example, with the rise of the consumer culture, society has never been more aware of image and in particular self-image. Through branding of the self, positional goods and social interaction, individuals aim to affect others' perceptions of them. Many subcultures choose to define themselves based on such artefacts, skateboarders being a good example. Skateboarders have a well–defined dress code, and this dress code is open to personalisation but still distinguishes them from other cultural groups. Brands such as Animal, Oakley and DC, to name a few, have sprung up, taking advantage of the unique style and dress sense of the skater community wanting to distinguish themselves from other subcultures such as Goths, hip hoppers and football supporters. Whilst clothing and music offer skateboarders a means of distinguishing themselves from other subcultural groups, they use their boards to distinguish themselves not from other subcultures but from others within the same subculture – kudos. The skateboards owned, with their elaborate artwork, offer a new medium of expression that has been appropriated by the boarders to make personal statements. These implicit dress codes, music preferences and artistic expressions enable bonds and allegiances to be formed in these subcultures.

The understanding of these artefacts is continually negotiated and redefined. Often through technology this negotiation is extremely limited or the riged bounds of systems' architecture make such appropriated use at best problematic, and at worst, impossible. The Internet has made new means of identity construction and presentation available [138]. Personal web pages and blogs enable users to create tailored presentations of self, for example individuals can select and uploading pictures based on the interests of their friends. People construct different personae based on who will be privy to the information [36]. This concept of maintaining multiple facades is not particular to the Internet; throughout our everyday lives we constantly manage several different roles and behaviours. For example, the language used when talking to a friend would be completely different than if one was talking to one's boss. As yet the expressive nature of individuals has not been fully embraced by system designers. Ubiquitous computing can provide new openings for self-presentation and impression management as a whole. Through the introduction of more complex models of context that take into account a user's personal history, feedback and control over ones own information and automatic adaptation are all things that can be utilised to provide new forms of self expression.

1.5 Research Questions

As the previous sections show, the style of work in the thesis involves a holistic view combining several aspects of system design, implementation and use. Rather than focus on just one of these in a single statement, this thesis follows several interwoven threads expressed via the following three questions:

RQ1

How do users of ubicomp systems appropriate recorded data from their everyday activity and make it into a resource for expressing themselves to others in ways that are dynamically tailored to their ongoing social context and audience?

RQ2

What technology can be built to support ubicomp system developers to design and develop systems to support appropriation as a central part of a useful or enjoyable user experience?

RQ3

What software architectures best suit this type of appropriated interaction and developers' designing to support such interaction?

The thesis will show the different ways in which recorded data is used. Some users use it to reflect on themselves and it acts as a resource for supporting behavioural change, others use it to present themselves to others highlighting aspects of their life that might gain them kudos, and finally there are those who use recorded information for coordination. The thesis will look at how impressions are managed through the hiding and revealing of information in general and more specifically information that is digitally captured. With regard to the technology that best supports impression management, there are several different systems that test out various pieces of infrastructure. User trials of several systems were used to evaluate each of these different technologies and Chapter 6 highlights the most important technologies for impression management.

1.6 Role of Equator

The approach taken within this thesis is in part due to its setting within the Equator IRC[1]. Equator was a six-year, ten million pound Interdisciplinary Research Collaboration that involved eight UK universities. This meant that there was a large bank of resources and researchers, with numerous and varied skills that an Equator-funded student could draw upon. It also meant that rather than concentrate solely on a few small systems and user experiences narrowly focused the author's own interests and priorities, the work presented here involved several large ubicomp experiences, each involving research issues and techniques determined collectively by a group of principal investigators, researchers and students.

The Equator Group at the University of Glasgow is at the forefront of international ubicomp research for six years, creating many novel ubicomp applications, and studying these applications in use. Through Equator and related projects we advanced an interdisciplinary approach to ubicomp research that involves taking emerging technologies out of the laboratory and studying them *'in the wild'*. In so doing, we have placed the UK in a world-leading position in this field. The holistic view taken in the thesis and expressed in the research questions above, can therefore be seen to have grown out of the Equator approach.

1.7 Thesis Walkthrough

This thesis explores three broad themes: ubiquitous computing, games, and impression management. The aims of the research presented in this thesis are to show the significance of recorded data to impression management and what type of technology is best suited for sharing and presenting this information in an appropriate contextually specific way. The thesis itself highlights two major issues with regard to impression management: hiding and revealing, and accountability. Hiding and revealing is an important mechanism for controlling the information one gives about oneself in order to control the impression given to others. Being held to account for ones actions is often the reason why hiding and revealing particular aspects of oneself is necessary. However, it is also important to note how individuals construct both consciously and subconsciously accounts that can show they comply with the norms and values of a situation.

[1] http://www.equator.ac.uk/

While hiding and revealing are important mechanisms for managing the impressions one gives, technology often provides an all or nothing solution where information is made either public or private, or a complex array of access control parameters must be configured. These ridged approaches go against the more naturalistic way in which individuals control their impressions through the use of peers, backstage, and objects they use to position themselves against others with. This thesis shows, through a range of different applications, how recorded data is used in self-presentation. How this information is hidden and revealed, and why individuals need to use such mechanisms are discussed at length. Before, finally discussing how designers might design for this more naturalistic approach and presenting infrastructure that can be used in applications wishing to support it.

Chapter 2 examines the existing literature focusing on the three main topics outlined in the introduction, ubicomp, games, and impression management. Through several cases studies (presented at the end of the thesis), two main issues are raised with regard to impression management, these are hiding and revealing, and accountability. Hiding and revealing is discussed in Chapter 3 and accountability is explored in Chapter 4.

Chapter 5 draws on the previous two chapters as well as other issues raised in the cases studies and throughout the literature review. These are then brought together in a framework to aid designers in creating systems that explicitly take account of users need to manage the impressions they give to others. This chapter concludes with a set of guidelines that can be used as a reference as well as the more detailed framework.

Chapter 6 outlines important infrastructure for impression management in ubicomp environments. This chapter discusses several pieces of infrastructure used throughout many of the systems presented in the case studies highlighting their evolution and significance to impression management. Egor is the final piece of infrastructure discussed in this chapter and is an infrastructure for tailoring the impressions one gives about oneself digitally, driven by a user's everyday life.

Chapter 7 presents Ego a game that mixes online social networking with a mobile multi-player game. The aim of this system was to test the Egor presentation infrastructure. Finally, Chapter 8 concludes, drawing from all of the studies presented and highlighting the contributions made by the thesis.

Chapter 2 Background

In this Chapter there are several areas of background work that will be explored Our understanding of the world is something that is extremely important in how we interact with and interpret the artefacts and individuals that inhabit it with us. It is often the case that these understandings are continuously being revaluated and adapted through these interactions. In the first section of the background literature the author will look at how experience and negotiation are used in this process. Following on from this user appropriation will be discussed and how it can be supported through awareness and control mechanisms incorporated into computing infrastructure, this leads into a discussion of appropriation. Appropriated use is something that is extremely important to the work presented in this thesis. Appropriated use of different artefacts can be used to freely express one's self to others. Often this freedom of expression has been seen in many recent playful technologies and games in particular, and brings with it expectations and practices as to how one manages the impressions one gives to others. This section will conclude with a review of impression management literature. This review will incorporate how impression management has been observed in everyday settings and how individuals adapt aspects of their self-image to affect others opinions of them. This chapter makes continual reverence to how impression management has been done in CSCW and through the use of ubiquitous computing.

2.1 Understanding the world

We build up expectations of the world through our interactions with those individuals and artefacts that we inhabit the world with. These expectations are called behavioural norms. Norms, sometimes referred to, as conventions, are extremely important because they give us a common point of reference to understand and predict the world around us. In [113] Robinson states,

> *"The dimension of implicit, formal or conventionally readable "states" is essential as it provides a common reference point for participants. A sort of 'external world' that can be pointed at, and whose behaviour is rule-governed and predictable. But this 'world' is meaningless without interpretation, without the talking that maintains its meaning"*

This predictability is extremely important to our understanding of the world that we live in. For example, if one were to put one's hand in a fire then one would get burnt. This causal relationship helps us understand and predict the outcome of our interactions within the world. This notion is well understood by systems designers such as Robinson [113]

> *"Predictability is probably the best understood aspect of system design, in terms of functions to be provided, consistency and compatibility between them, and appropriate human interfaces"*

However, it is often the case that different groups have different sets of conventions that can conflict. This complexity is increased further since our understanding of the artefacts and individuals bound up within norms are also based on an individual's interpretation. For example to a diplomat, a taxi-driver, a naturalist or a designer, the car may be interpreted differently. To the diplomat, it may be a status symbol; to the taxi driver, it is an efficient means of transport; to the naturalist, it is a disturber of the peace and an environmental pollutant, and to the designer, it is either a good or bad design. Through group interaction certain meanings become dominant, whereas other meanings can gradually become less significant. Robinson highlights this by stating,

> *"Implicit communication can only happen when the participating actors are able to maintain an evolving set of rules, understandings, and expectations about the meanings of actions, signs and changes of the common artefact".*

Therefore, expectations of others are built up through the predictable nature of particular situations and the actions that are appropriate to that context. However, these expectations are being continually negotiated and redefined. This negotiation is very important otherwise the use of norms and conventions can become problematic. In [97], Mark presents a study of workers as their work practices are forced to change during the relocation of their offices from Bonn to Berlin in Germany after the unification of the country. In [97] she highlights the importance of convention use in collaborative work and how feedback provides an important mechanism for maintaining accountability for one's actions. She studied the use of a groupware system called *PoliTeam*. The lack of feedback afforded by the system and the distributed groups involved in the work, meant conventions where not adhered.

Mark makes an important distinction between shared conventions and the mechanisms put in place for the purpose of coordination.

> *"Such mechanisms are designed to regulate coordination through a protocol, which designate procedures surrounding a particular artefact."*

The difference is subtle but important. Conventions are often dynamic and change over time where as the computational mechanisms put in place are often static or relatively static, relying on system designers to adapt and change them as required. In general, conventions are used on a day-to-day basis to regulate many types of group interactions including communication between individuals, the sharing of artefacts and even the control of negative social processes such as cheating when playing games. The ability to create a dynamic structure that enables the negotiation of conventions between group members is extremely important for this reason—in Chapter 5 and Chapter 6 a design framework and software infrastructure for doing just this are discussed. If the members of the group are able to use existing conventions brought in from their daily lives (see A.5.4.3) and create and adapt new ones then conflicts should be resolved in a more naturalistic way through interaction between the group members. This has also been observed by Health and Luff [79]:

> *"The ability to coordinate activities, and the process of interpretation and perception it entails, inevitably relies upon a social organisation; a body of skills and practices which allows different personnel to recognise what each other is doing and thereby produce appropriate conduct"*.

Therefore individuals are more likely to be able to predict how another may act in different circumstances. Also the more an individual adheres to the group's conventions the higher the expectation that others will adhere to those conventions in the future. The convention then, as Mark puts it, represents mutual knowledge and expectations in the group. Expectations have a significant role to play in impression management; they provide individuals with a frame in which to construct any performance. If they stray from these expectations they are likely to be held to account for their actions. Also, adhering to particular conventions can be a way of paying respect, as Goffman illustrates [67]:

> *"It may be illustrated from recent material on doctor-patient relationships, where it is suggested that one complaint a doctor may have against some of his patients is that they do not bathe before coming for an examination; while bathing is a way of paying deference to the doctor it is at the same time a way for the patient to present himself as a clean, well demeaned person."*

As we can see it is widely recognised that through their use, conventions emerge within group work, and dynamically change and adapt as group members come and go, something observed during the study of several systems such as, Media Spaces [11], Speakeasy [46], and George Square—see A.1. Also, managing the impressions one gives to others, adhering to particular expectations, and following the conventions put in place, are imperative if one is to give an appropriate presentation. This is done through the creation and adaption of 'mutual knowledge' of not only situations but also the artefacts and individuals that make up each encounter. The common artefacts that inhabit the many encounters one finds oneself are extremely important in grounding conversation and spoken exchanges, and Robinson [113] suggests that they are essential for explicit communication. The two important characteristics of any common artefact, outlined by Robinson are predictability, and 'double level language'.

> *"Double level language is a phrase intended to catch the idea that implicit, often indirect communication (through artefacts) and explicit communication (speech, ad hoc notes) are not alternatives, but complementary and mutually supportive".*

While both Mark and Robinson base their research within a work setting much of their observations can be applied and seen throughout the act of impression management. The construction and performance of any presentation requires the use of artefacts that are common to both the presenter and the audience. In this way the presenter can provide a *'meaningful performance'*. While both Mark and Robinsion discuss objects as common artefacts that maybe used to coordinate activity, in impression management these common elements may include other individuals. In this case individuals may be used to confirm and maintain a given performance, giving credit to the claims the presenter is making. Those who support a performance in this way maybe referred to as 'The Team' [68]. However, as will be shown in Chapter 7 and again in Section A.4 the team does not always act appropriately and can sometimes discredit a performance, making it open to attack, and its' members subject to retribution.

2.1.1 Accountability and Trust

Accounting for one's actions is imperative, in impression management, if one cannot account for his or her actions this may lead to the subject being chastised by those present. In everyday encounters face-to-face communication acts to provide a mechanism through which others can be held to account if they do not adhere to a group's norms. In her work Mark [97] reiterates the importance of face-to-face communication and highlights the barrier posed by working in a distributed environment in negotiating and enforcing a groups conventions.

> *"[I]n face-to-face groups, where stimuli for feedback purposes is readily available, the group has at-hand means for effectively controlling violations of conventions. In groups not in close proximity, there is far less opportunity for providing."*

The proximity of the collaborating actors is most important to the formation and enforcement of conventions. However, it is not the reliance on proximity but the accountability [125] for one's actions inherent in face-to-face communication that is important here. Regular feedback about an individual's activity is inherent in groups that work in close proximity to one another, which in turn maintains their accountability to the other members of the group. Problems arose in the groups studied by Mark since there was a lack of feedback due to the distributed offices preventing the group's members from holding those not conforming to the agreed practices accountable. Mark states

> *"Feedback plays an essential role in this accommodation process, to reinforce appropriate behaviours in the group and to direct people away from inappropriate actions. Violating conventions may not be so obvious as when group members are face-to-face. Also, feedback sanctions on violations may be weaker."*

Like the groups studied by Mark, presentations made in online environments are often made at a distance over either time or space and often across both. This makes it difficult for individuals to backup any claims they might make about themselves in a timely fashion. In Joinson's study of Facebook[2] users [86] this problem is noted and he highlights how players construct profiles that '*show'* their characteristics and traits rather than

[2] http://www.facebook.com/

profiles that *'tell'* people that they have particular characteristics and traits. This is supported by incorporating information captured from everyday activities into digital presentations (see Sections A.1, A.5, and A.6). This enables others to see what one is 'up to' and keep-up-to-date on the happenings in one's life. However, as Joinston, states this involves a degree of surveillance from the audience, which shows that they are attending to the individual and that their 'mind is with them' [115]. This in itself can act to maintain relationships at a distance. Indeed, Walther et al. [132]state that Facebook profiles serve as a mechanism through which individuals can invest in and maintain ties with distant friends and contacts. In [11] Bly states the significance that maintaining ties with others had on the use of Media Spaces:

> *"A central demonstration of the Palo Alto-Portland link was not only that the technologies supported work activity, but that the group could and did maintain itself as a single community. People regularly referred to all members across sites as 'we'. People could and did move among projects and areas. People within the group depended on others, regardless of location as resources of work and play."*

While social networking can be used to maintain ties it can also be used to develop new ones. This requires that individuals create credible representations of themselves. Similar to the studies done by [61, 63] which have looked at how individuals make credibility assessments of web pages individuals that use social networking sites, dating sites, blogs, and other digital presentations of themselves must make them credible.

In Whitty's study of online daters [137], the ultimate aim of the user was to meet someone who he/she could go on a date with. Therefore credible presentations of self that could be backed up during a face-to-face encounter were extremely important. This acted to prevent or at least curtail what the users said about themselves. A language where the daters could tell if others were misrepresenting, or hiding things about themselves, subsequently built up overtime. Daters expressed that particular profile picture styles were designed to hide particular things. Most daters perceived individuals that include the traits or characteristics that they typically express in everyday offline social settings, as honest and genuine people. This is in keeping with Fogg who states in [62]:

> *"Web credibility increases when users perceive a real-world organization and real people behind the Web site."*

Highlighting that websites that "lists the organisations physical address" and that "shows photos of the organization's members" were more credible. When there was a discrepancy, as Goffman [68] predicted, the online daters in Whittys study judged their dates as immoral, believing they had an obligation to match the impressions created by their profile. Impression management relies on being able to confirm any claims one makes about one's self. If a presentation is not in keeping with the audiences understanding of the presenter, he or she will be seen as a fake. In face-to-face communication individuals can be readily made to account for their actions and any claims they make about themselves, however, online this is not as easy. As the daters in Whitty's study have shown being able to bring in outside information to confirm a presentation can be valuable in backing up the claims one makes—bringing in outside information captured from everyday life to online presentations is further discussed in Chapter 7.

2.1.2 Awareness

So far the thesis has looked at normative behaviour and its importance in understanding and interacting in the world. Within CSCW the focus on awareness both of one's own activity and that of those we work with is extremely important in achieving effective group work—including impression management. Indeed we can see this importance in the work done in London Underground control centres [79] and the London stock exchange [78]. The previous section highlighted the importance of holding individuals accountable for their actions and how appropriate behaviour, based on the give situation, is maintained. Face-to-face communication is important in ensuring that group members follow common conventions, therefore this section will progress focussing on awareness, defining the term and discussing appropriate models of awareness that have been used in CSCW and ubiquitous computing.

Awareness is something taken for granted by users, however as technology becomes increasingly embedded into the real world, including collaborative and socially oriented software, awareness becomes a fundamental consideration for designers. As human beings, awareness is an everyday constant experience where we aggregate and interpret the objects in the environment around us. We regularly gather information both from the focus, and the periphery, of our attention. Although awareness is something we all deal with seamlessly on a day-to-day basis, it is an extremely complex concept that if asked to explain what it is to be aware or what the experience of being aware is like, most would

have difficult in finding a concise answer. Liechti [94] draws our attention to this difficulty,

> *"[Awareness] cannot be very precisely and uniquely defined".*

Schmidt [116] also admits that the concept of awareness in CSCW is at best vague. He suggests that the confusion results from such notions such as 'passive awareness' and false dichotomies such as 'explicit' versus 'implicit', 'deliberate' versus 'automatic', 'conscious' versus 'unconscious', 'focused' versus 'unfocused', or 'obtrusive' versus 'unobtrusive'. Schmidt also highlights our ability to attend to multiple sources of information.

> *"The fact that actors take heed of occurrences beyond their immediate task was and is seen as something of a paradox. The paradox reflects an underlying assumption [in this area of research], namely that focus or attention is by definition exclusive, like some kind of mental tunnel vision."*

Awareness is a relative concept. Some may conceive that humans may be partially aware, where the object of interest exists on the periphery of their focus or fully aware of an object giving their full attention to it, however, awareness is not as clear-cut as this. Instead it is more fluid with artefacts and individuals moving from the focus of our attention to the periphery and back again. This is similar to Heidegger's [109] notion of '*ready to hand*' and '*present at hand*'. The first is when you act through something, and the equipment fades into the background. In [41] Dourish gives the following as an example,

> *"You feel as though you are operating the menus, icons and so on directly, and not as though you're asking the mouse to do it on your behalf."*

The second, present-at-hand, is when the equipment—the mouse—becomes an object of study in its own right. Instead of it being something that equips you for a task, you have bumped up against some aspect of its nature that makes you focus on it as an entity. Weiser [135] describes technology that can "*move easily from the periphery of our attention, to the centre, and back*" as '*calm*' technology. This fluidity of awareness is very important in the management of the roles one has to perform on a day-to-day basis, this is discussed further in Chapter 2 and shown in the study of George Square—see A.1. One of

the first definitions of awareness in CSCW was proposed by Dourish and Bellotti in [43], they stated,

> *"Awareness is an understanding of the activities of others, which provides a context for your own activity".*

This definition highlights the interdependency between awareness and understanding of artefacts and individuals. Indeed it shows the importance of behavioural norms and conventions, without which understanding of the activities of others would be impossible. Self-awareness as well as awareness of others is extremely dependent on the particular situation or context one finds oneself (also see Section A.5.4.1). Dourish and Bellotti highlight the significance that the context one finds oneself in, has to play in awareness and understanding of activity. Context awareness and adaptation are key areas upon which the work in this thesis is built and is discussed throughout the subsequent sections and chapters.

Our awareness of other artefacts and individuals is extremely important in how we conduct ourselves and participate in collaborative work environments. In their study of ShrEdit Dourish and Bellotti present findings that show how people's own awareness of particular aspects of the system affect their behaviour [43]. They observed how individuals have the opportunity to peripherally monitor others' activities, and comment on them, so that an individual, even when working independently, is both communicating their activities (allowing others to avoid duplicating her work) and providing others with the opportunity to comment on the activity or observe consequences for their actions. In doing so they noted, "users can explicitly tailor their contributions knowing that others can see them". While the mechanisms here are different from that of the PoliTeam the fact that users are made accountable for their actions makes them think and adapt their behaviour appropriately.

Occurrences like this are not uncommon or restricted to technology use. In [69] Goffman recognises that awareness of the situation one finds oneself, is extremely important in deciding on how one should conduct oneself.

> *"In performing a role the individual must see to it that the impressions of him that are conveyed in the situation are compatible with the role-appropriate personal*

> *qualities effectively imputed to him: a judge is suppose to be deliberate and sober; a pilot, in a cockpit, to be cool; a bookkeeper to be accurate and neat in doing his work. These personal qualities, effectively imputed and effectively claimed, combine with a position's title, when there is one, to provide a basis of self-image for the incumbent and a basis for the image that his role others will have of him."*

As Goffman states here the social pressures to adhere to "*role-appropriate"* behaviour prevent or make it difficult for individuals to disregard others expectations of them when participating in a given role. In CSCW several system have used this as a metaphor for access control rights. Systems such as [59, 102] use such mechanisms. However, the way roles have been used in these systems is restrictive and static. The users are limited to the abilities assigned to their given roles and negotiation or changing of these roles is difficult. Unlike everyday collaborative activity where it is much more common that the roles of individuals change regularly or even that an individual has to attend to multiple roles [122]. For example, an author may also be an editor. This is also a point highlighted by Goffman [69]

> *"It is a basic assumption of role analysis that each individual will be involved in more than one system or pattern and therefore, perform more than one role. Each individual will, therefore, have several selves, providing us with the interesting problem of how these selves are related".*

Dourish and Bellotti also criticise these types of *"formal and static"* role based access control mechanisms championing the more *"subtle and dynamic"* approach of the document editing system ShrEdit. There are several other early CSCW applications that shared this view. Benford et al. [56], used the spatial metaphor inherent in 3D environments to provide flexibility in access control. The social constraints of who could take up which positions—for example a, speaker at a podium—here are enough without explicit, technically, controlled access based on roles.

As has been stated, our understanding of the world and the expectations we have can help us predict how specific behaviours will be received. Roles facilitate this by providing those who fulfil them with a set of guidelines of what is expected of them and in turn enable others to predict how someone fulfilling a given role will act. This mutual awareness of 'presenter' (someone fulfilling a given role) and the audience maintains that the

expectations are met [11]. However, mutual awareness between individuals is not always possible For example, a stranger may stare at us whilst we are oblivious to their attention. Through technology, particularly social networking sites [13, 36, 86], this type of behaviour has become increasingly prevalent. This can affect us in many ways, firstly unlike face-to-face communication we are unable to react to our audience and tailor our presentation to the given context. Given that this is the case, presentations of individuals can be made that misrepresent them or present aspects of themselves that are not appropriate to the context, therefore showing the individual in an unfavourable light.

While technology has introduced new ways in which one might present oneself while not co-present, the potential for misrepresentation is not restricted to presentations made through technology. Other third party presentations can be subject to the same misrepresentation for example, when one is talked about when absent although, the level of control over the presentation is different. Goodwin's [72, 73] analysis of the Maple Street group highlights the consequences of talk about an absent party and the mechanisms that the *"spoken about"* party uses to confront the "speaker". This type of talk is commonly referred to as *"talking behind someone's back"*, which Goodwin points out is considered an offence within the Maple Street group (see Section 7.1.4.4). Therefore the act of confrontation in a *"he said she said"* dispute enables the "spoken about" person to demonstrate that they do not lack character. In her examples, while the result was conflict between two parties it provides a crucial opportunity for the "spoken about" person to stand up for him or herself, refute any claims made, and publicly regain face within his or her peer group. Knowing this to be the case, speakers are aware that they may be held accountable for their actions and request that their utterances be kept secret between them and the hearer. The impact of this for self-presentation is that reports can be challenged; also information that is not reported is usually confined to local group otherwise eventually it *"gets back to"* the spoken about person. The fact that information is exchanged and forgotten about allows the children in Maple Street to move in and out of conflict and friendship with one another. Problems result when the information is no longer transient, whilst also being made available to a wider audience. This can result in the ostracisation of children from their social groups as the following quote shows.

> *"Withdrawal from the scene of the confrontation indicates a certain level of seriousness in the encounter. Being absent from school by 'turning in sick' is a strategy for terminating disputes quite similar to the practice of avoidance in other*

> *cultures. One very serious he-said-she-said led to the defendant's ostracism from her play group for a month and a half and to subsequent ridicule in song by her friends during that period. Indeed, talk about talk can lead to serious consequences: depriving someone of her basic rights to interact with others in her play group. Confrontations do not, however, lead to permanent rupture in social relationships or to more violent behaviour, as in some societies."*

In this case the dispute is long and drawn out but not indefinite; eventually what was said is forgotten about and relationships mature and move on. Through digital presentations it is not as easy to '*forget'* and move on as Grudin suggests in [76]. Grudin highlights how technology has made "*transient information more permanent*" and how "*local information is made available globally"*. He states that the loss of confinement and transience of information—shown in the interaction among the Maple Street children, creates an environment that is unfamiliar and in conflict with the one we live in.

The permanence and global nature of this has profound affects on managing one's own impression. Whilst we are all products of our past, we are able to subdue or discard inappropriate elements of it, as each individual moment requires. With information becoming globally available and permanently stored its representation overtime becomes distorted presenting a *previous you* designed for an audience that may not be there any more. Instead the new audience may be subject to a completely inappropriate performance. Grudin gives the following examples to illustrate this,

> *"I went on the job because one of the two models got sick, and the other one was Claudia Schiffer. Obviously I was kind of the nobody, so she got all the work—it was a week in the Seychelles, and they were like, well, we'll shoot a couple covers on you when we get a chance. I was 17, maybe 18, and they asked me to take off my top for one of these pictures. (Amber Valleta, model and actress, New York Times, June 25, 2000)"*

> *"It just brought up a lot of questions, because now that I'm older and married and I have a 14- year-old stepdaughter, and she sees me naked on a Web site, I'm like: How am I going to respond to her? (Rosie Perez, actress, New York Times, June 25, 2000)"*

In cases like this, the subject of the audience's attention (the '*spoken about party'*) may be unaware, or over time forget, about the artefacts left behind to represent him or herself. Therefore out-of-date and misinformed representations might be made that are inappropriate. For example, Rosie Perez, no doubt, tries to convey herself as a loving caring mother; topless modelling is not one of the attributes often associated with this kind of persona. While this may have other repercussions for the individual, such as the refusal of a job or some other loss of face that may prove problematic, the individual may not find out that such a presentation is being made about them. Goffman [66] states the severity that this type of extreme loss of face can have and highlights how keeping such things hidden is imperative in preventing this from happening.

This raises traditional CSCW questions about privacy and awareness. Within the area of self-presentation and impression management what information is private and what information is public is extremely complex. Recent research by Dourish [42] has discussed the complexity of privacy in the social world. Dourish recognises along with Grudin that just by knowing that the digital information that we generate is likely be stored and indexed transforms how we communicate and present ourselves to others. Often this knowledge comes about from bad experiences in which individuals get their '*fingers burnt'* similarly to Rosie Perez above.

The information we give out and are made privy to by others is often defined by the relationship that we share with the individual. While others may be aware of our presence, our feelings, convictions, and affiliations are often concealed. For example, friends and family are often privy to more sensitive information than strangers. When our control over who is given access to sensitive information is taken away or lost then problems like those discussed above occur. This section has explored several key issues relating to impression management, feedback, control, and appropriate behaviour. All of these issues rely on awareness to inform the presenter and in particular they rely on an awareness of the current situation or context.

2.1.3 Context awareness

Context awareness is fundamental in our understanding of actions and interactions by and with others. Context-aware systems have to have a means to capture information so that it can be used to model the current context and provide the system with data that enables it to adapt or support the users current situation. Dey and Abowd [35] define context as

> *"[A]ny information that can be used to characterize the situation of entities that are considered relevant to the interaction between a user and an application, including the user and the application themselves".*

Bellotti and Edwards also highlight the importance of the social aspects of context through their framework for intelligibility and accountability in context-aware systems [7]. Dey and Abowd go on to describe specific features of context:

> *"[T]ypically the location, identity and state of people, groups and computational and physical objects"*

Chalmers [22] notes that such definitions are common in context-aware and ubiquitous computing but that they tend to emphasise objective features that can be tracked and recorded easily. He criticises this stating that these definitions

> *"[D]e–emphasize or avoid aspects of the user experience such as subjectively perceived features and the way past experience of similar contexts may influence current activity—issues which are central concerns of CSCW."*

Chalmers further points out the importance of treating human activity not as a series of separate perceptions, instead treating it as an ongoing temporal process, therefore suggesting that the past is an integral part of a human's current context. This seems like a logical suggestion since as humans we are constantly learning from our past successes and mistakes. Our current context and what makes us who we are, consists of every small moment since birth in which one has changed and adapted oneself into the person one sees before the mirror each morning. Chalmers suggests:

> *"[F]eedback loop, in which the instantiations of social practices as well as memory, experience and understanding, influence and partially constrain activity and interpretation"*

He also acknowledges that ongoing activity and interpretation of new events leads to an expanding experience, a change in understanding and an adaptation of social structure. While taking past activity into account may prove a better view of the current context, the

technology at our disposal has finite resources. Every piece of information cannot be gathered and stored throughout a lifetime. Moreover, we do not have the models or sensor capabilities to model the complexity of a human and his or her actions and interactions. Indeed, Chalmers backs up this point,

> *"Any digital system is finite and physical, [which] limits what it can record of people's activity, what it can represent internally, what mechanisms of adaptation are encoded in those internal representations, and what external representations such as output devices it can use."*

Chalmers also goes on to stress that while it is inevitable that designers have influence over meaning, through the finite nature of computational models of context, it is often good to leave as much as possible of this interpretation open to the users. He suggests that this can be achieved by revealing what the underlying system is doing, which is also supported by Dourish [39] to provide users with a means of understanding and predicting how their actions will be reflected by the system. However, even if we had the modelling and storage capabilities, we must always be aware, as Grudin's [76] critique of Dey's work suggests, that recognising and communicating context via technology may provide more efficient and effective work practices, "but capturing context digitally, fundamentally alters it".

Social networking sites, MMORPG, personal blogs and instant messaging clients are a few of the applications that have allowed individuals to present themselves to others. There is a range of motivating factors that individuals have for doing this. Some want to make friends and others want to be someone else but whatever the reason these applications continue to gain in popularity. When it comes to self-expression, however, they are relatively static compared to the continual adaptation involved in managing one's impression in everyday life. Few take advantage of the contextual information that is available. Some support the use of information captured throughout everyday life such as photographs and video. However, while most individuals have an abundance of ubiquitous devices at their disposal none of these systems take advantage of this. For example, most mobile phones now have GPS, accelerometers, and WiFi, as well as Bluetooth, GPRS, GSM, cameras, and SMS, all of which could be used in capturing information for self-presentation. While these technologies could make more of a connection between our everyday and online lives currently very few are used to do this. For some this is exactly the way they want it for others it hampers the construction of online presentations. In Appendix A several systems

that capture different elements of an individuals activity that is subsequently shared to others are discussed and in Chapter 7 Ego, a game about impression management, shows how this type of technology can be used drive a tailored self-presentation system.

2.1.4 Appropriation

Awareness is extremely important in creating an understanding of the individuals and the artefacts we inhabit the world with. This shared understanding is imperative when using these artefacts to construct appropriate presentations of self. These shared understandings are shaped by a variety of factors, marketing, word of mouth [14, 15], play [5, 10, 30] and friends [13]. Taking this into account, we should be designing to enable every user to shape and change the technology to best suit him or her. Therefore the technology facilitates the user in designing or adapting a system to best fit their own needs and desires [21] rather than working against it. This requires us as designers to provide support for use that we cannot anticipate beforehand [21, 22, 40]. Carroll suggests the challenges to designers are two fold:

> *"[D]esigning malleable technologies that can shape, and be shaped to, users' organisational, social and personal practices, and then harvesting users' needs from the appropriated innovation to design future versions or technologies".*

This use of malleable technology is referred to as appropriation and is imperative in impression management. There are obvious advantages of creating the same system for all for example, by having common features, support can be more readily provided by others. Their understanding built up during use can be shared and used to help solve any problems encountered by friends, family or work colleagues. In a completely malleable system such common features may not be as apparent or even available, making this type of help virtually impossible. However, appropriation of technology is intuitively inevitable since our everyday lives see us appropriating all sorts of objects to fulfil tasks they were not originally designed for. Take, for example, the hanging of curtains in the home. When trying to reach the curtain rail, a person may use a stepladder, which has been designed purposefully for that job. If, however there is not a ladder available, rather than go all the way to a hardware shop to buy a ladder, people often stand on a chair to give them the extra height to reach up and hang the curtain. Our everyday lives are littered with examples of such appropriation. Dave Curbow describes appropriation as follows,

> *"Appropriation describes how people designate something (a tool, a machine, some software) to be used in a particular way"*

Therefore suggesting that people often prefer to improvise, like using a chair instead of a ladder to hang curtains, rather than be forced into performing the task at hand in a formalised prescribed manner. This seems like a simple notion and it fits with everyday activity as shown in the previous example. Dourish [40], however defines appropriation more specifically for technology.

> *"Appropriation is the process by which people adopt and adapt technologies, fitting them into their working practices. It is similar to customisation, but concerns the adoption patterns of technology and the transformation of practice at a deeper level."*

He suggests that appropriation should be thought of not just from a social perspective but instead as the *"intersection of technical design and social practice"*. Here the link between user created meaning, understanding, and how system design influences this can be seen. However, if we design systems that allow for emergent patterns of use and activity we increase the flexibility and potential for appropriation. These emergent patterns not only allow more efficient use, they reshape the technology itself. Customisation of technology, for example, is extremely common; people often customise things to mark individuality. For example, lets consider the mobile phone; users can modify it adding ring tones and screen savers, and even change the hardware appearance with covers. Customisation in this way helps people make statements about themselves, similar to how jewellery or clothing are used, to do so. Another particularly good example of technological appropriation can been seen through the use of PARC's Media spaces, in [11] Bly states why such appropriation was made possible:

> *"The value of the media space was that it was available and present across a range of activities. It accomplished this not by being neutral or 'all-purpose' but by affording appropriation to each of the particular groups and activities. It offered a means of maintaining group working relationships and group work in a way not previously available"*

Appropriation can also be much more fundamental in helping people gain a deeper understanding of the technical features through exploration. Again looking at the mobile phone, the signal strength meter enables users to determine if they can make or receive calls in the current context. Therefore, when a user can't make a call, he or she can diagnose what the problem is based on a very simple meter and try and move to an area where they are able to make the call. Although users do not necessarily know about cell towers and their explicit coverage they are given enough information to understand why the technology has broken down and how to fix it. This helps in the acceptance of the technology. At PARC users of the Media Space system encounter several limitations with the system such as the lack of a shared drawing surface but the users devised ways around this by repositioning cameras to display their sketches. These emergent practices were then explicitly designed for in subsequent iterations of the technology.

Dourish [39] outlines a broader view of customisation than the traditional perspective of HCI, stating that incremental adaptation of interactive technologies is inherent to the emergence of practice, and practice is inherently shared. In our mobile phone example, a small change in the technology (tagging callers with ring tones) has enabled the emergence of a new caller ID practice that others have become aware of and adopted through interaction and discussion with others. Similarly the close link between the Media space designers and users meant that new and emergent practices could be explicitly designed for as well as being adopted by others. This is similar to Carroll's notion of users' activity being shaped by the technology but also the technology being shaped by its users. Chalmers notes that appropriation is imperative to the adoption of collaborative technologies and has been also been observed in, email systems and Lotus notes [23].

The dynamic nature of social interaction and system use results in the continuous emergence of new patterns of activity, often unforeseen by designers. Grudin [76] notes that whilst Trigg, Suchman and Halasz had raised this issue in CSCW in 1986, software applications are still 'socially blind'—a point reiterated by Erickson and Kellogg [51], despite the efforts of many researchers to improve this. People regularly call upon the experiences of others. An example is the use of plug-ins for Internet browsers. As new plug-ins are released users notify friends of their existence and their experiences with them. This information is also posted and shared on the Internet in online communities. There are several lessons to learn here; provided information is made available people can appropriate based on prior experiences, as CYSMN [30] illustrated when players made use

of the limited GPS coverage to ambush the online players. As designers, we must try and predict what will happen with a tool and support users in their task. In order to achieve this, Chalmers suggests interweaving digital media and selectively revealing their differences to try and trigger more exploratory practices. He also suggests encouraging and supporting users to be aware of or even inquisitive about our systems by revealing more of the underlying technology to them Appropriation is a powerful concept in technology design; it enables users to make use of past experience gained from social interactions, observations and other interactions with objects and technology. It is for this reason that appropriation is extremely important to impression management.

2.2 Fun and Games

Games are an integral part of this thesis. The study of games in their own right is extremely important in our understanding of identity construction and presentation in online gaming communities in particular. However, while games are of interest in themselves they are also important as vehicles or test beds for new technologies—this is specified further in Appendix A where the systems studied as part of this research are described. This section will first look at online games and how identity construction, reflection, and general impression management are done in this environment. The section will then discuss mobile games and their use in this thesis as test beds for technology and conceptual ideas as well as objects of study in their own right.

2.2.1 Online games

There are a multitude of different gaming platforms, from the more traditional board and card games, to consoles and computer games. Console gaming, unlike traditional board games, has focused on gaming as an individual experience, with very little attention on collaborative experiences. Recently designers have moved away from this supporting more collaborative playing environments in which players from around the world can meet up and play with one another. An increasingly large number of console games are being designed around online play or at least have an element of online play designed in so that players are able to engage with the game long after any pre-authored story content has been completed.

The Internet offers a vast array of online games ranging from text-based games to massively multiplayer online games (MMORPG), which have large 3D worlds such as

Blizzard's World of Warcraft[3] (WoW). The large environments of many of the new MMORPGs' are inhabited with millions of users. WoW has approximately 10 million users[4]. In these environments complex economies, personal identities and social networks are created and evolve over time. Allowing individuals to buy and sell their wares and in some environments allowing them to exchange digital artefacts for what most would term 'real world' money. Often academics see games and the physical world as separate with a clear distinction between online avatars and physical world bodies. In [99] Mortensen points to the distinction players make between in game characters (IC) and out of game characters (OOC).

> *"For the gamers, knowing the difference was essential to good role play because confusing them would pollute the play and pull game concerns into the real world, and vice versa. An example of such pollution might be a player claiming it needed to win because it had such a crappy day at school and losing a confrontation in the game would make it worse. The rule is that what happens in the game is only valid in the game and if you learn something outside of the game, that might be valid for the game, your character does not know this until it has been told in-game."*

However, this distinction may be somewhat misguided, it has been shown in the previous section that, experience and understanding are intertwined. Therefore any experience we have in the physical world helps our understanding of the digital world our avatars inhabit. Also things that happen *in-game* can affect our *out-of-game* lives. For example, more traditional forms of games such as football no one would find it peculiar if one suggested that the game itself affected the life of the individual players and vice versa. Players having a hard day at work will be physically fatigued and their performance will suffer as a result. Also a bad challenge in the game may leave them with a broken leg therefore preventing them from working. Why is it so difficult then to imagine that digital games have similar affects on the individuals that play them? What is undeniable is that players do make a distinction between what is appropriate in-game and what is appropriate out-of-game; However, this distinction is no different from deciding how to interact in a group of work colleagues in the office or with a group of close friends in the pub.

[3] http://www.worldofwarcraft.com/index.xml

[4] http://en.wikipedia.org/wiki/World_of_Warcraft

There are several instances in which the boundaries between the physical and digital worlds are crossed [24]. Although most of the publicised cases of when the boundary is crossed are often when something bad happens[5]. In the Legend of Mir 3, which featured heroes and villains, sorcerers and warriors, many of whom own swords and other weaponry, there was one particularly remarkable event. An individual playing the game had won a particularly prestigious weapon and lent it to his friend who proceeded to sell the artefact for 7,200 Yuan. The original owner reported the theft but since the law did not consider the artefact to be 'real' nothing could be done, this lead to him subsequently stabbing and killing the individual who had stolen the 'in-game' sword. This is a particularly gruesome example but it seems ridiculous that digital artefacts, such as music or video, are considered '*real'* and have owners—and are subject to copyright laws, and yet other artefacts are considered '*virtual'* and therefore are thought of differently. In [127] Taylor expresses concern over this current 'virtual' versus 'real' divide in the current research community.

> *"Researchers and theorists should consider how simple divisions of "virtual" and "real" may not prove to be very useful in accurately explaining what happens in multi-user environments. Instead, we might see what happens when we broaden our notions of embodiment to include both corporeal and digital forms"*

Jakobson in [84] also proposes that we take these so called 'virtual' objects more seriously. He argued,

> *"[T]he inanimate objects of a [virtual world] are as real as objects in the physical world although different."*

He suggests that the "symbolic significance" that digital objects carry with them, lend themselves to real relationships, interactions, and values. Taylor explicitly states that we must include avatars, or digital body objects, in this category.When managing the impression one gives to others it is the symbolic significance of the individuals and artefacts that one chooses to affiliate oneself with that helps position him or her against others. This is regardless of whether the artefacts are physical or digital. However,

[5]http://www.smh.com.au/news/World/Online-gamer-killed-for-selling-virtual-weapon/2005/03/30/1111862440188.html

Eladhari in [47] does make the distinction between characterization and '*true character*' she quotes McKee's definition of characterisation defining it as what is merely observable.

> *"Characterisation is the sum of all observable qualities of a human being; everything knowable through careful scrutiny: age and IQ; sex and sexuality; style of speech and gesture; choice of home, car, and dress; education and occupation; personality and nervosity; values and attitudes—all aspects of humanity we could know by taking notes on someone day in and day out."*

She goes on to state that all these things applied in a game world would be what we could see and note about another player character (PC) or about a non-player character (NPC) fairly easily by having a few conversations and maybe teaming up once or twice for common causes, like hunting or questing. However 'true character', on the other hand, is not always so easily seen.

> *"[T]rue character is revealed in the choices a human being makes under pressure—the greater the pressure the deeper the revelation, the truer the choice is to the character's essential nature."*

This distinction is important because it can be made in any game whether it is situated in a digital or physical space. The distinction here is that people can role-play with their true beliefs only becoming apparent when challenged. In 'A Tale In The Desert' this idea of 'true character' can be seen in a controversial stance by one of its players[6].

> *"'Along comes a foreign trader, with shiny new goods, and an attitude that's totally offensive, totally out of line with the culture that has developed in our Ancient Egypt. Would you trade with him? Would you put aside your morals, if it meant you'd get an advantage that many people don't have? In real-life, would you patronize a store that had a "no Jews allowed" policy? What if they had *really* good prices? Would you do it and hope nobody saw? Maybe feel guilty?'*
>
> *The best books, movies, television - can provoke a range of emotions. I like books that make me feel happy, enraged, triumphant, guilty, enlightened, said. I want to*

[6] http://slashdot.org/comments.pl?sid=126745&cid=10604460

have all of those emotions available in an MMO, and emotions occur in players, not characters."

While 'true character' is shown through our interactions over time, some players explicitly go out of their way to present aspects of themselves through their avatars and representations. As relationships are built up this type of interaction occurs more frequently with increasingly personal information being presented. Eladhari also points out that this is an important part of game play because most players don't role-play a fictive character, instead they choose to play themselves in the game world. The blurring of the boundaries between in-game and out-of-game experiences can be seen most prevalently in the relationships that are shared with individuals on both sides of the divide. In [101] Nardi and Harris presents an immersive ethnography of Blizzard's World of Warcraft. They both observed how chat between players often focused on aspects of their current out-of-game context such as the local weather or that they should be studying for a test they had the next day. Also as relationships evolved within the game, players shared more personal information to give one another a better sense of who they were. While out-of-game information was brought into enrich the in-game discussion, other outside influences had direct impact on the game play itself as the following example from [101] shows.

"I need to stop for the night - my wife is getting ancy :)"

This comment was made after a prolonged period of group play between two individuals who previously did not know one another but teamed up in order to complete their common goal. It is clear from these examples that the physical world and digital world are intrinsically linked. Their norm structures and values may be different from our traditional everyday experiences however this difference in culture can regularly be seen between others with different races, religions or cultures from around the physical world. Using 'real' world experience one can often decide how to behave in a 'virtual' world. Alternatively if one finds oneself in an unfamiliar situation they can accustomise themselves with the situation and learn the norms and values through trial and error [127]. This in-game socialization process is extremely important in learning how to behave in a new setting, however, it is no different from that which is undertaken on a daily basis. Socializing oneself is an extremely important step in establishing relationships and affiliations with others. Affiliation with others is another significant aspect of self-presentation.

2.2.2 Identity

Complex relationships can be formed both in-game and out-of-game, between those one knows and complete strangers. Throughout the course of interaction between players these relationships can traverse the physical, digital boundary. It is these complex relationships coupled with the ad hoc opportunistic relationships formed with strangers that make MMORPGs so compelling to their audiences. Some of the most compelling aspects are the construction, adaptation, reflection and presentation of self that individuals must do throughout their gaming experiences. Identity and its expression is one of the key elements discussed time and time again by players. When managing ones identity online through the use of an avatar both the individual and the individual's representation (the avatar) are affected by one another. This reflects the previous argument that the digital and physical worlds should not be separated. Taylor [127] highlights this,

> *"Ultimately, digital bodies tell the world something about your self. They are a public signal of who you are. They also shape and help make real how users internally experience their selves."*

The character is an extension of a players self, like Dourish's example of the mouse, it is an object to be acted through. However, avatars are also objects themselves to be reflected upon by the user. Eladhari in [47] notes,

> *"Most players play at a level of representation and often have several characters. In the most extreme state of immersion, the object that a player controls is not seen as a representation."*

This raises the question how is characterization in these game worlds different from how we get to know people in everyday face-to-face life? While some have suggested that since this is not everyday life then this characterization is completely different. Although this is not something the author agrees with. Characterisation is a concept that has been strongly tied to pre-authored fiction and therefore most do not consider or perceive themselves as performing any kind if "self-characterisation". However, as the work of Goffman has shown, while we may not perceive ourselves as engaging explicitly in characterisation we do implicitly change our character befitting any given occasion or situation. Eladhari in [47] has noted how players see this characterisation.

> *"We could argue that [virtual game worlds (VGW)] are fictional and therefore all types of expression of information about a certain player character must be seen as characterization. But many players see the time that they spend in VGW—and especially their lived relations with the other players—as a parallel reality, possible to compare to a vacation or to any kind of social situation that has other types of conditions that the "everyday" has".*

Eldhari [47] notes Sherry Turkle's observation of this in multi-user dungeons (MUDs).

> *"[I]n MUDs, "there is an unparalleled opportunity to play with one's identity and to 'try out' new ones. MUDs are a new environment for the construction and reconstruction of self". Taking identity as a concept, it often refers to "one", just as we only each have one physical body. However, in contemporary theories the concept often refers to having several identities depending on context; this is something that we all recognizes in today's differentiated society where we use different (context-dependent) roles".*

This reflects directly Goffman's notion of impression management in everyday life. In games, like social networking sites, personal blogs, and even our everyday life, the self we wish to portray is continually evolving. Constructing, presenting, reflecting and adapting these presentations is a continual ever-present process, whether we are aware of it or not. Creating characters in online games is specific to the particular game framework but most let the player choose from among a range of different character types, such as race, classes and profession. Some game designs allow players to also choose gender and to customize the appearance for example eye and hair colour, clothing etc. These fixed categorisations that can be used to define one's own character in an online game, can also be found in social networking sites to define oneself. They are often restrictive, however users inevitably find ways around these constraints—ways to appropriate the technology to support the impressions they wish to give. In The Dreamspace [127] players were able to change the heads of their avatars, which they used as ways of expressing themselves. In Taylor's [127] study of The Dreamspace she noted that the act of changing heads and customizing the avatar is something most users spent an enormous amount of time doing. This act of continual change of expression with avatars being constantly worked on is directly comparable to our behaviour as individuals in everyday life. She also observed how individuals tailor their avatars depending on the contexts they find themselves in.

> *"Since heads can be removed at any time and "pocketed," and another easily put on, it is not uncommon to find people switching heads based on particular social situations."*

Not only did she observe this moment-by-moment appropriation of the avatars to suit the given context, several of her interviewees expressed how they saw themselves also evolved and changed over time. From this observation Taylor noted, "the avatar head became a central object around which some performance of identity was structured". The players' experiences and understanding of the norms and values of the shared game space were the key motivating factors in this evolution.

Digital games offer new ways to experiment with one's identity that are impossible—or at least very difficult, in everyday life, such as gender swapping. Such activity was not seen as distinct and separate from the individual's true self. Instead, the anonymity provided by these online games enable users to detach themselves from their actions and therefore express aspects of themselves or experiment with different roles more freely. This is illustrated by Meg, one of the users of The Dreamscape that Taylor interviewed, who choose to initially use a cat's head on her avatar, as this was her favourite animal, explicitly expressing this notion.

> *"Although it wasn't a particularly conscious process at the time, choosing an animal head instead of a human one was a way of giving myself leeway in my in-world actions and absolving myself of some of the responsibility of "acting human". It was also somewhat of a protective measure, a way of not getting too close to people until I really knew what I was getting into.*
>
> *If people didn't like me as a human, it would be a definite reflection on my waking world self. If they didn't like me as a cat, somehow that wasn't as serious an issue because after all… I'm not really a cat, so it's not really me they don't like."*

This scenario is not uncommon as people are always conscious of how they act in new settings, often they are excused because they are, a '*tourist'* and may not be accustomed to the ways of the situation in which they are immersed. This may be seen as them having their tourist head on. The direct accountability afforded by ones physical body however

may result in individuals behaving with more tact since they cannot start again as is the case in games. For example, dressing more conservatively on the first day of a new job until one has found out the appropriate protocol and been initiated into the new environment. In distancing herself from her avatar in this way Meg could preserve her own sense of self and if her actions, through her avatar, where shown to be inappropriate she could attribute them to her character and not her directly. This allowed players to experiment with their characters enabling them to become socialized into the environment and create and appropriate their avatar to best suit their personal needs. Indeed Taylor notes several instances in which players experiment with their character's attributes to create an avatar that best suits them.

Discussions and dialog with others are also extremely important in understanding the etiquette of any particular environment. Eladhari states, "Dialog is a powerful tool for characterization". Dialog and discussion enable common understandings to be built up and the performances individuals' give can therefore adapt and evolve as this understanding is built up and changed. This ongoing negotiation between individuals enables them to adapt and change, conforming to the appropriate norms and conventions in order to fit in. The use of dialogs and stories to understand the context in which one finds oneself and managing one's own impression is shown in Section A.4 and Section A.6 where the findings from Ego are discussed.

In online environments avatars or other representations are used for a range of different purposes. By customising their avatars individuals can express their own personal interest and views they can tailor them to given occasions, such as guild meetings or other types of group gatherings. Using the ability to customize and change the appearance of their avatar enables players in online games to express their relationships with other players and in particular to show their affiliation to other groups. As Taylor expresses

> *"They don't simply chat in disembodied spaces, but use their avatars to gather for social events like weddings, community meetings, games, and simply hanging out"*

By meeting in this way it can be seen that players went to great lengths to show their affiliation to others. There are even more dedicated players that use the expressive nature of their avatars to actively show their participation and affiliation with others. In The Dreamspace there was a large Christian community who would regularly meet and pray

together using their avatars to gesture as they would in church. In this way the players performed in the digital space as they would in the physical space through the avatar using it as a vehicle to express their participation and connection with other Christians in the game. Other more subtle forms were also employed that helped players how their affiliation to one another but keep this secret from non-members.

> *"While the fine distinction between a 'rare' gray and a common one are likely to go unnoticed by outsiders, those within the group can signal their 'insiderness' with these kinds of avatar modifications".*

Showing affiliation like this is not unique to The Dreamspace, many MMORPGs have guilds, which in turn provide individuals with other ways of showing affiliation. This performance can be played out in numerous ways involving gestures, clothing, jewellery and other personal artefacts that may be available in the course of play. The affiliations individuals make can be used to make a statement about who one is and support the impressions one wishes others to perceive. However, on reflection these affiliations might not help maintain the impression one wishes to give and the association is cut short.

2.2.3 Reflection

Avatars and other presentations of self act as 'mirrors' [48] through which individuals can reflect upon themselves and the impression they are giving to others. This is illustrated by how players changed the heads they had on their avatars to express their moods.

> *"Avatars can thus be reflective material, used to explore both ones inner self and the social world. As Meg put it. "[i] usually change my avatar head to suit my moods, or experiment with other's reactions to different appearances, or to see how different looks affect my own actions and comfort levels"*

One observation made by Taylor that is extremely interesting was how some players came to identify their avatar as 'more them' than their corporeal body. One man in particular expressed this feeling,

> *"I identified this brown cat as me more than I identify my picture with me. I see Leanardo more often than I see myself in the mirror or anywhere […] I can't see 'me' in the WW ['waking world'] but I can see 'me' in DS [Dreamscape]. When I*

look at the brown cat I know I am looking at me and also that everyone else who sees that brown cat also sees me… I like that continuity… I take comfort in it."

This idea that one sees themselves in the character they are playing is a clear indication that players feel that they not only project themselves into their digital representations but that they see these representations as true representations of them. It fits with the notion of experimentation that Taylor also found, where players try out a presentation and adapt based on the reactions to it (see 7.1.4.2). In the Dreamscape this is possible because of the perspective you play from.

"I'm interested in the ability to see myself as others see me"

While Goffman has spoken about how we are perceived by others in general social settings, in The Dreamscape the same observation was made,

*"But I have experimented quite a bit, and the one thing I've found most interesting is that people treat you based on how you present yourself, and if you pay attention, you'll notice that *you* change depending on how you present yourself."*

"Avatars are in large part the central artefacts through which people build not only social loves, nut identities. They become access points in constructing affiliations, socializing, communicating, and working through various selves. They are the material out of which people embody and make themselves real. What they are and what they can be matters."

Eladhari [47] goes as far as to state that the absolute core point of virtual worlds is the 'celebration of identity', where individuals can develop a second self or persona and that 'virtual worlds enable you to find out who you are by letting you be who you want to be'. Engaging in these social environments then would not be as compelling or addictive were it not for the audience in which one shares their performance with.

2.2.4 Audiences

This notion of the 'heroes journey' [47] highlights the importance of having an audience in online games. Many writers have noted the importance of having others see what we are

doing as an extremely significant aspect to playing MMORPGs. In [45] Ducheneaut et al. states this,

> *"Indeed, the other players have important roles beyond providing direct support and camaraderie in the context of quest groups: they also provide an audience, a sense of social presence, and a spectacle. We believe these three factors can help explain the appearance of being 'alone together' in multiplayer games."*

Ducheneaut also goes on to say that,

> *"MMORPGs are in essence reputation games - an avatar wearing powerful items, for instance, is essential to the construction of a player's identity. It broadcasts the player's status to others and rewards him or her with a sense of achievement. And without an audience of other players to whom these items could be displayed, the game would make little sense. The ability to construct an identity as an 'uber' or 'elite' gamer is where MMORPGs are truly social worlds – grouping with others can be just a means to an end, which can be sidestepped depending on playing style. Put differently it is not 'the people that are addictive' but rather, 'it's the image of myself I get from other people'."*

Ducheneaut rightly states that designers should take such behaviour seriously, and instead of merely focusing on encouraging people to group, he suggests that we should also design for audience/player interactions—as does [112]. Therefore it would seem to make sense that players should be able to make more of their everyday activity in a game setting enabling players to more uniquely define their characters and therefore themselves. The importance of creating one's own unique identity can be seen thought the effort and continual evolution of the development of individual avatars throughout an individuals play. An interesting incident in The Dreamspace discussed by Taylor is one in which an individual tries to copy another players avatar.

> *'One of the more bizarre twists on this theme was an incident where one of the top administrators of the world found out her avatar (which took the form of a robed oracle) had been copied and the graphical representation inserted into a competing virtual world by another user. Interestingly enough, it was this incident that bought to light a peculiar legal feature of her digital body. She explained, "I came to work*

and found out that I was copyrighted and the way I found this out was someone had stolen me and now there was a legal fight over m – my body, my head, and my name" '.

This incident highlights again the link between the physical and digital. However, it is the feelings expressed which highlight the individuals close relationship with her avatar. So strong was this bond between individual and avatar the individual felt that their self had been stolen they were so enraged by this that they took legal action. This raises a host of privacy questions that must be considered when designing for impression management. How can one construct presentations that are credible and confirmable? In part this can be done through affiliation, with those people and artefacts acting to back up the claims one makes about oneself.

It is clear from this that the investment in a characters creation is more than something superficial that is just to be used in interacting within the game. Even those players who role-play characters that may seem extremely distant from their true character do so with a great personal investment in that character. So far this section has explored our understanding of the world and how it is built up through our experiences with those individuals and artefacts that we inhabit it with. This section has gone on to discuss identity and its construction, in particularly in online games and social networking sites.

2.3 Impression Management

So far the thesis has made significant reference to the work of Erving Goffman and in particular his work on impression management. This work examined how people control the information that they give out to influence how others perceive them. Goffman likened impression management to a performance put on by an actor. In his dramaturgical analogy of impression management he defined several different participant roles and 'stages' that contribute to the performance. The 'stages' Goffman defined were '*back stage*', '*front stage*' and '*off stage*'. A performance can be seen to start 'back stage', where the performance is constructed, rehearsed, or adapted between scenes. On the *'front stage'* the performance is give to the '*audience*'. The audience can be actively engaged in the performance, however, those who are aware of the performance, but not engaged with it are said to be '*off stage*'. Goffman states that those that are part of the on-going performance, and are collaboratively involved in the presentation being given by the '*performer*', for example the stage crew of a show, can be seen as the '*team*'. It is

important to note this terminology here because it is used throughout the remainder of the thesis.

2.3.1 Impressions 'given' and 'given off'

In order to successfully present oneself to others appropriately, control over impressions 'given' is extremely important. However, this can be difficult with impressions 'given off' sometimes working against the presentation. While one can try to control what information is 'given' through consciously dressing or speaking in a particular way, body language and other subconscious gestures can act to 'give off' information that can be used against the performer to discredit the performance [71].

Therefore concealing and revealing information is imperative in constructing and presenting oneself appropriately in everyday life. Deciding what information should be concealed or revealed is totally dependent on the audience. It is also the case that the performance given should reflect the performers actual self, although this might not always be the case. If it is the case that the performance is overly disparate the performer may face repercussions from the audience observing them. In general identity construction is extremely complex, and it cannot be observed in isolation. A personal identity is dynamic and is constantly changing, based on the context of a given situation—including the audience. The culture and subcultures one aligns oneself with, and the relationships between people and artefacts, all play a significant part in how one wishes to be perceived. This construction is highly tailored and extremely intricate. This point is noted in [138] where Zhao et al., suggests that identity is not an 'individual characteristic', instead it is a 'social product' that is the outcome of the social environment and is therefore performed differently depending on the context one finds oneself in. Zhao et al. also back up the notion of accountability by stating that the onymous environments—such as social networking and dating sites—hold individuals accountable for their actions and are therefore more likely to provide a more accurate portrayal of themselves than in anonymous environments. Zhao et al. also note that it is wrong to think of the online world and the offline world as separate.

> *"[I]t is also incorrect to think that the online world and the offline world are two separate worlds, and whatever people do online 'hold little consequence' for lives offline. In the Internet era, the social world includes both the online and offline*

environments, and an important skill people need to learn is how to coordinate their behaviors in these two realms."

While this shows how intricate and dynamic managing one's impression can be, the key to successfully achieving this is learning to control the impressions, 'given' and 'given off', both in the physical and digital world,. In many of the online environments and social networking sites discussed previously the image presented to the world, unlike everyday life, is extremely static unresponsive to our interactions in the world, unless explicitly updated. ,Computational devices are becoming increasingly pervasive in our everyday lives, computers are built into almost everything, from the electronic controllers in your car to mobile phones, children's toys, household appliances, furniture and even clothing. Gathering this information in real-time, and using it to dynamically reconfigure and present an image of oneself to an audience, would provide a much richer means of self-expression. The control of what data should be gathered and to whom it should be displayed must ultimately lie in the hands of the user. Expression in this way would enable users to include whatever data they wished such as location, application use, their social network and many other things which we use in common human-to-human interaction.

2.3.2 Tailoring presentation

In most of the work where technology is involved it is often the case that the technology is used to mediate and support human-to-human interaction [60]. Presently there are no systems available, which make use of everyday activity to dynamically reconfigure and augment a digital self-presentation to others. By providing a richer means of self-expression and reflection individuals are able to refine the presentations they give, therefore influencing how others perceive them. This is especially important for those who must attend to several different roles that conflict Component technology aims to create flexible reconfigurable systems which users can customise to meet their own needs and given situations. Having an adaptable system would mean that not only could users choose, based on a designer's predefined set of logging and presentation components, but they could also create or use other components, similar to how clothing was produced and sold in 'There' [15]. This raises a host of trust and security issues, for example which components, and from whom, can be trusted to perform as advertised? While it is not the aim of the thesis to look at malicious code and the security issues that arise from it getting into a system, it should be noted that privacy and security of information is of importance. If an audience is made privy to the private information of a performer this can discredit the

performance. Therefore, it is necessary to provide infrastructure and components that involve and notify the users when automatic or authored presentations are made. This feedback and subsequent control enables users to come to an understanding about what is acceptable behaviour and hide, reveal or adapt aspects of their presentation to best suit their future needs [2, 8]. Many architectures handle privacy by providing an extensive access control list, which is often difficult to maintain Especially since privacy is continually negotiated and informed by the different contexts one finds oneself in.

Often there is a tension between hiding and revealing particular information when considering privacy. In online dating [48], the tension between what to hide and what to reveal is due to the accountable nature of the prospective face-to-face encounter. This requires mediation, between presenting an enhanced or desired self and presenting a true reflection of oneself [36]. In reputation systems, there is a tension between the presenter and the audience regarding whether the information being conveyed is correct and can be trusted, and how to prove or verify claims about oneself in order to appear trustworthy to others [37, 49, 107]. This tension is continually changing, as ongoing activities change both appearance and experience. Our own experiences and understanding of the world, the artefacts that inhabit it, and others that we live along side are continuously being re-evaluated. Notably our interactions with other human beings are subject to continuous assessment and re-evaluation. Indeed, the complex nature of such relationships dictate that our understanding of individuals and groups is constantly evolving and being reshaped. This assessment and re-evaluation process serves not only as a way of getting to know and understand others, but also serves as a frame of reference within which we can assess and re-evaluate ourselves. Personal identity is something that is constructed carefully based on our observations and understanding of the outside world. Bodily adornments provide more scope for tailoring and customising ones identity. All of these characteristics contribute to the individuality of a person. However, it is our social encounters that enable us to attach meaning and understanding to these objects and to our actions. These meanings are extremely subjective, what is ‘cool’ for one person may not be for another!

2.3.3 Affiliation

It has been shown how context, and the expectations of others, can influence how we conduct ourselves when interacting with other people and artefacts. Certain situations require us to perform a different role or present different aspects of our character. In these situations it is a common requirement that individuals adapt and change the performance

they give and is something that we all do on a regular basis. So far the thesis has discussed how on occasion two or more roles that we play may contradict, and if exposed, can result in us being thought of as 'two faced'. However, successfully managing multiple-roles in our everyday life is essential. While, individuals must work to maintain the expectations of them based on their give role they must rely on others to backup and support the performance they give. In [68] Goffman refers to these individuals as the 'team', where all must play their part in maintaining a common façade and stating that destructive information, which could jeopardize that façade must be controlled. Roles, as pointed out by Walker [131] generally refer to expectations surrounding a given status or patterns of behaviour which are afforded to that given status. These expectations and patterns of activity enable an audience to assume knowledge of the presenter and thus infer knowledge of that person's identity. The notion of a role encompasses not just expectations of others but also self-reflection. Walker tells of how McCall and Simmons describe role-identity as the 'character and the role that an individual devises for himself as an occupant of a particular social position'. Again the construction of a character fulfilling specific in game roles is extremely prevalent in online games and has been discussed in Section 2.2.2. Such positions are constructed from social preconceptions, observations of others in similar positions (see Chapter 7), self-reflection (see Section 1.1) and feedback based on actions from the audience.

One may choose to present oneself in a particular way, however, this is continuously modified and adapted to incorporate different artefacts and characteristics depending on the audience or activity we are currently involved in. For example, vocabulary changes in conversations between friends as opposed to conversations with parents. The clothes worn in the gymnasium may be completely inappropriate in the workplace. Our role in society and within certain circles is pre-defined by our culture and surroundings, which have dictated that we dress in a particular manner or behave in a particular way depending on the situation. It is through presentation of self as individuals that we create and conform to these given cultural identities. Our personal identity is made up from many complex facets, which are constantly changing over time, based on our experiences and our interactions. This makes it something that is constantly being re-evaluated. Within technology much of this information and dynamism is often lost, by reducing the complexity of identity into a finite set of static categories. This allows people to be directly compared against others, quickly, if not accurately.

Computers and technology are not only an important communication medium through which individuals may present themselves. They are also used as status symbols (or *positional goods*) that enable one to position oneself in society. Today the desire for even the most common household artefacts to be more aesthetically pleasing, instead of merely providing the necessary functionality, has greatly increased. For example, it is no longer adequate that we can watch our favourite shows on our televisions. Consumers demand a more socially acceptable or advantageous experience, such as watching through thin LCD displays that set them apart from their peers. Since this has become the case it is no longer unusual to talk about 'beautiful computing' [87, 105]. Hirsch [81] recognised that what is consumed is strongly influenced by how it can be used to position ourselves with respect to others. Here consumption acts as a zero sum gain, 'I benefit at your expense' You give me envy, as my social position is raised through my expensive purchase. Under this glare 'beauty' is not necessarily something inherent in an object, or even in the good taste [12] of the observer, but as an owners ploy. In this way taste is used to distinguish us from others, particularly through the consumption of finite resources, such as houses or fine art. Ubiquitous technology, while being seen as an artefact in its own right to be used to support the impressions—such as using iPods or mobile phones as status symbols—one wishes to give, is also extremely powerful in enabling passively logged information to be incorporated into digital presentations. This logged information can even be used to drive adaptation and tailoring of an individual's presentation of self when he/she is not there to react to any given audience who may be viewing a digital presentation—see Chapter 7.

2.3.4 Ubicomp and Impression Management

Due to the increasing use of technology throughout our everyday lives, it is unsurprising that it is being used to control how we present ourselves to others. The author has already discussed social networking sites, personal websites, blogs, and the way in which they are used to project oneself to a larger audience. The dangers of static presentations have also been discussed, however the author has highlighted how ubiquitous technology can be used to adapt and change individual presentations to best suit the audience. With this in mind, mobile ad hoc networks, enabling mobile devices to connect to one another and serendipitously interact, are extremely important. In Chapter 6 technological support for this type of interaction is discussed. Also, component based architectures that enable components to be interchanged are also very important in supporting impression management. Such architectures enable users to personalise and customise their systems to best suit their needs and desires. An example of this type of architecture is presented in

Section 6.4 and an adaptable framework for self-presentation is also discussed in Section 6.5. In the following section the author will discuss the general issues with this type of technology, focusing particularly on impression management.

2.3.4.1 Mobile ad hoc networks

As Mobile devices with increased power, faster communications and higher resolution displays are increasingly saturating our everyday life, commercial location-based services that run on these devices, such as restaurant finders, are becoming more established. At the same time, research into new location–based services continues to move forward, in areas such as wayfinding, cultural tourism (see Section A.1) and games (see Sections A.2, A.3, and A.4). Studies of the experience of ubiquitous computing services 'in the wild' [118] [119] have also begun to appear in the HCI literature, revealing the ways in which users interact with ubicomp technologies, and identifying new design challenges and opportunities.

A topic of recent interest has been the use of mobile ad hoc networks (MANETs) as a way of distributing information between mobile and stationary users. Although research of MANETs has been extensive [95], applications that make use of them are extremely sparse [54]. One of the earliest systems of this type was Pollen [65], a system that used mobile clients as data carriers, exchanging information as they moved around. Other systems such as FarCry [128], Jabberwocky [50], Humming Bird [111] and Hocman [52, 53, 55] used ad hoc networking to provide awareness of others in the environment. Esbjörnsson et al.'s Hocman [55], in particular, demonstrates how URLs and user profiles can be exchanged using serendipitous ad hoc networking between motorcyclists. It enabled motorcyclists to exchange personal web pages of information whilst riding. Indeed, Hocman is one of the first widely known systems to successfully utilise 802.11 MANETs as the communication technology of a mobile, peer-to-peer application. In [55] the authors' state:

> *"Operation without an infrastructure fits well with biking since traffic encounters can take place anywhere"*

However, this statement can be extended to most mobile systems as the location of devices, and the likelihood of these devices being near an infrastructure node when they encounter one another, cannot be easily predicted. While Hocman was designed to support these fleeting interactions between bikers, the short web pages they produced and

exchanged gave them opportunities to present themselves to others in a new way. The motorcyclists would customise their web pages to highlight aspects of their bikes and 'show off' their general knowledge about the subject. MANETs provide a suitable infrastructure through which this could be done However, the evolving nature of self-presentation means that managing one's own impression requires moment-by-moment changes to any presentation given, as the situation requires This was not possible in Hocman and privacy again became a problem. The users could not specifically tailor the presentations they gave nor were they given any tools that helped them to author the content they wished to display. For example, the system could have passively logged where they went and enabled them to cut sections out to display as good routes to drive. This restrictive infrastructure prevented individuals from taking full advantage of the freedom offered by MANETs.

2.3.4.2 Component Architectures

In [11] Bly discusses the use of Media spaces, a collaborative working environment that provided individuals, who were not co-located, with awareness of one another and provided a communication channel through which work could be done. There were several factors that shaped the use of this system including, *'group size, the working relationships within the group, the physical proximity of members of the group to one another, the nature of the work, and the group's approach to work and social relationships'*. Bly recognises that the different needs and situations require different configurations and specifies what is required of a system in such situations:

> *"Different settings require different media space configurations. For example, commonality of purpose and the degree of openness about work are indicators that an open technological infrastructure can accommodate the group activity."*

This again highlights the need for open technological infrastructure that can be appropriated by users to best fulfil the task at hand. While this adaptation often arises in the social interaction around software systems, more recently making more adaptive (or personalisable) systems that can facilitate this behaviour at a deeper system level have been explored. Findlater & McGrenere [58] made a significant step towards understanding how best to facilitate this type of customisation and adaptation. They defined two main types of personalised interfaces: adaptive and adaptable.

> *"Adaptive, or system-controlled interfaces, and adaptable, or user-controlled interfaces both provide dynamic approaches to tailoring interfaces to an individual user"*

In their study of adaptive and adaptable interfaces Findlater & McGrenere unsurprisingly found that the majority of those participating in their study preferred personalised interfaces. However, they preferred adaptable interfaces to adaptive ones—those that kept user 'in the loop'. Keeping users 'in the loop' in this way, is one of the core principles of 'recombinant computing', as defined by Newman et al. [103]. The three guidelines that they laid out were,

1. Employing a small, fixed set of generic interfaces
2. Using mobile code to allow components to extend one another's behaviour at runtime
3. Keeping the user in the loop in deciding

Recombinant computing is a design technique that allows communications between computational entities with limited prior knowledge of one another, to simplify configuration by end users [103, 104]. Speakeasy [46] is an example of such a system which is "designed to support ad hoc, end user configurations of hardware and software, and provide patterns for data exchange, user control, discovery of new services and devices, and contextual awareness". Jigsaw [82] was another user configurable system similar to Speakeasy. However, it differed in that it focused on allowing users to understand the arrangements of connected sensors, devices and services, for example, a doorbell, SMS sender, and camera and display. Jigsaw allows users to configure ubiquitous domestic environments using an editor, based on a jigsaw metaphor, to make connections between components more intuitive. Connecting jigsaw pieces together works by dragging a particular piece to a fitting target piece. However, Jigsaw's end–user adaptation relied on a simple set of categories used to map physical effects to digital effects, designed *a priori* rather than adapting dynamically with use. By designing recombinant computing systems in this way the aim is to enable users to customise and make use of different resources, that best fit their patterns of work. Even if these resources used by a set of individuals are different when performing the same task. The author has already shown the problems faced by individuals using online dating sites when forced into using predefined categorisations. In [48] the lack of support for adaptation meant that users had to

appropriate the categories given, and work around the limitations of the system. Using component-based architectures the flexibility required for individual impression management can be provided since users are no longer restricted to a prescribed set of tools. Instead, users can choose which aspects of their lives they wish to incorporate into their self-presentation. Also, by providing such an opening framework they are able to create new components that can support unforeseen uses. The decisions one makes over which components to use to present oneself, can also reveal as much about the individual as the information gathered, and presented by the components themselves. By thinking of components as ways in which to categorise activity we can draw from Bourdeau [12], who states,

> *"Categorisation categorises the categoriser"*

This statement highlights the significance of the categories themselves as well as what someone chooses to put in these categories. Giving individuals the freedom to choose these categorise for themselves can add a further dimension to their personal presentation. Therefore allowing users to choose which components they wish to use in constructing their presentation of self is extremely important. However, this is not simply user defined categorisation, since there would be no way for these social networking sites to provide the tools for searching and finding new friends. Therefore, unless there is a shared understanding of what each component or categorisation means, users have no way of interpreting the behaviour witnessed by others, this was highlighted by Mackay [96],

> *"The act of customizing software is generally viewed as a solitary activity that allows users to express individual preferences. In this study, users at two different research sites, working with two different kinds of customizable software, were found to actively share their customization files with each other. This sharing allowed the members of each organization to establish and perpetuate informally-defined norms of behaviour."*

In an early study of how people within an organisation share their modifications of customisable software Mackay shows how these customisations are spread throughout a community. Some individuals would customise their own configurations to be able to work more efficiently or simply to suit their personal tastes. Others with less time or expertise, would not customise their own configurations, instead they made use of other 'successful'

configurations. This sharing process had many benefits; time to configure one's own computer was reduced, shared working practices were developed, and expertise was passed on. Mackay declares the following requirements concerning the design of customisable software:

1. The ability to browse through others' useful ideas;
2. Better mechanisms for sharing customisations;
3. Methods of finding out which customisations are used and effective, and
4. Methods of identifying customisations that are ineffective.

Mackay continues by outlining a design implication from these requirements:

> *"Reflective software should increase the user's awareness of how they actually use the software. Techniques used to instrument software for feedback to user interface researchers may be useful here."*

The term reflective software here describes an information channel for allowing users to discover their own patterns of use, and as a beneficial consequence, it allows users to monitor their own activities. This type of reflection is imperative to impression management and especially in behavioural change as will be shown in Section A.5.4.1.

2.4 Conclusions

This chapter has shown how individuals' understanding of the world informs the process of impression managing Common understandings make situations predictable in that individuals know how to act given the specific context they find themselves in. This Chapter has shown how roles create expectations of those who fulfil them making how they will act more predictable to those around them. However, it is often the case that individuals must attend to multiple roles, which may on occasion's conflict. In these cases it is important to be able to control the information about oneself. In cases where third parties present an individual to others, either through talk [72, 73] or through digital presentations left behind [138] this control is taken away. By not being able to respond in a timely fashion to those privy to the performance may result in a serious loss of face. This raises the question how can multiple roles be adhered to in digital presentations?

The chapter continued by discussing accountability and how it acts to prevent inappropriate behaviour. One of the most important mechanisms available for preventing people from disregarding the norms and values of a group was face-to-face communication [97]. However, when this was not present then individuals would either disregard the common convention set out or use conventions more appropriate to their work and the work of their group. In other situations, such as online dating [137], the potential for face-to-face interaction prevented individuals from misrepresenting themselves. Being able to account for one's actions is prevalent in social networking, and individuals using Facebook [138] and other such sites could be seen to affiliate themselves with people and artefacts that would help them present themselves appropriately. Therefore, providing the opportunities for individuals to account for their actions and in turn making individuals actions accountable is very important for impression management.

While accountability can prevent individuals from deliberately misrepresenting themselves, misrepresentations can be made inadvertently. For example, if individuals are not able to adapt the presentation they are giving in an appropriate and timely fashion an inappropriate presentation will be given to the audience that will be difficult to rectify. This raises two important points highlighted by Grudin about the nature of digital representations. He states that the loss of confinement and transience of information fundamentally alters it. The author has shown how this can be detrimental to a user, and how in face-to-face communication things are forgotten about and individuals move on. Responding to these two issues is imperative for impression management when digital presentations of self are made.

The remainder of the thesis will look at each of these issues drawing from several studies presented in Appendix A. The focus of the following chapters will be on hiding and revealing information, and accountability, after which a design framework for impression management is outlined. Following this, a chapter discussing the evolution of architecture that supports tailored presentation of self, called Egor, is presented before a final user trial of the infrastructure itself.

Chapter 3 Hiding and revealing

3.1 Introduction

Controlling the presentation one gives in a particular context is extremely important and is done through the hiding and revealing of information. Feedback provides users with the necessary cues needed to determine whether a presentation is suitable or not and supports the ongoing adaptation of any presentation. This chapter will discuss dynamic roles, appropriate behaviour, individuals used to support presentations of self, and the impact of impressions given-off. This chapter will draw from several of the studies presented in Appendix A.

To support individuals and the multiple roles they must fulfil, hiding and revealing information is imperative to presenting oneself appropriately in any given setting. 'The Team'—individuals that support the impressions one wishes to give—are imperative in providing credibility to the performance and on occasions work together to present a common façade. Members of the team, through impressions given-off, can discredit these presentations inadvertently. Impressions are also given-off during technology use through the sharing of information or the physicality of most of the mobile applications drawn from. It is with these issues in mind that the author considers hiding and revealing and its significance to creating accountable presentations—see Chapter 4.

The aim of this chapter was to explore how hiding and revealing is conducted over a range of new ubiquitous technology. Drawing from these many different technologies and a variety of application areas several guidelines are draw out from the findings presented.

3.2 Dynamic Roles

Throughout an individual's everyday life there are many occasions that require him/her to adapt and tailor the presentation given depending on the situation and the audience made privy to the presentation. Similarly the roles one takes are dynamic and changing, with one having to fulfil the role of father, husband, work colleague, and manager. In order to support the fluid transition between the different roles individuals must be able to adapt and tailor their sign equipment or behaviour. In George Square the design of the system facilitated this fluid transition by enabling users to change their behaviour and use particular features of the system that best suited their current context. George Square is a

mobile tourist application that enabled visitors to share their visit with friends and family at a distance. This was supported through several different communication channels, users could talk with one another over an audio link and they could interact with one another pointing to areas of interest by tapping on a map and sharing pictures and web pages that augmented a visit —for more detail see Section A.1.

Those who were visiting the square often took pictures and went to physical locations, supported by their co-visitor who was not co-located who would look up web pages and supplement the information. Collaborative activity like this often requires roles of individuals to change and in some instances they can be swapped over, as in George Square. In Shakra the role individuals took depended on those involved in the interaction. Shakra is an activity monitoring and sharing application that was designed to increase awareness of one's own activity levels and to encourage individuals to get more exercise. The system highlights the number of minutes of moderate activity an individual gets and aggregates this to show when they have managed to achieve the minimum recommended daily amount of exercise (30 minutes). This activity can then be compared against and shared with one's peers—for more detail see Section A.5. Some individuals would be cooperative and supportive of particular group members trying to encourage an increase in their daily activity levels. On other occasions, often with different group members, users would be more competitive using the awareness system in a playful way.

In Castles the players utilised a variety of personae to augment the game. Castles is a multi-player mobile strategy game, similar to Stronghold or Age of Empires, designed to take advantage of the Domino component architecture. This architecture supported the dynamic integration and removal of components into a running system. Castles took advantage of this by creating game components that represented buildings that could be used to produce soldiers to take into battle with other peers—for more information see Section A.4. The various personae used to augment the game could be categorised as follows: the *Informant*, the *Bluffer*, the *Thinker* and the *Joker*. *Informants* were players who often felt the need to express their own game mastery through sharing their knowledge with others. These players did not always have to be prompted into giving their opinion or advice; they often did so merely to 'show off' to the others in the game. The *Bluffer* was a player who, like in poker, sent out information that was either incorrect or deliberately designed to be misconstrued by the other players. In order to be successful, these players had to be very careful about the information they revealed or concealed to

others. The *Thinker* were players who did not participate much in the ongoing conversation between the other players, instead choosing to 'hold their cards close to their chest', in the hope that by giving very little away they would be more successful. The final character was that of the *Joker*, who contributed hugely to the fun had throughout the game. It was often the case that every player took on this role at some time during a session. This meant that banter and jest were common elements of the ongoing game experience. While the players took on these particular personae, sometimes moving fluidly between them, they all shared in the construction of the stories used to understand the game and its underlying infrastructure.

Performing any role requires a tailoring of oneself to fit with the expectations associated with the role. Tailoring can be done by adapting one's physical appearance or acting in a particular way. In day-to-day life this is rarely done consciously, instead individuals implicitly dress and behave as appropriate based on previous experience. On occasions such as job interviews people consider these aspects much more. With digital information this tailoring can become overwhelming with individuals having many different types of information that they might use to present themselves. However, technology can offer a means to dynamically tailor and adapt information to aid this process.

3.3 Appropriate behaviour

George Square, Castles, and Ego all provided users with technological mechanisms for adapting and tailoring information. In George Square it was retrospective with users able to tailor the record of their visit by cutting out aspects using the weblog. In Castles information was tailored through the use of Domino, providing the users with recommendations through which they could dynamically configure their system setup by incorporating new components. The common motivation for tailoring information in these systems was to present oneself appropriately. Other systems presented in Appendix A also highlighted the need to be seen to behave appropriately although it was not supported by the technology. Instead users would incorporate others, to back up any claims made, or hide information that might be damaging.

While behaving appropriately was a primary motivation for users of many of the systems studied, explicit system-appropriate behaviours were not established at the beginning of the trials, however these developed during system use. The users used several of the systems to tell the 'story' of their play, and narrate events as they happened, revealing and

concealing private information as necessary. In the systems where competition developed, mostly in the games but also in Shakra, hiding information was a skilful pursuit that required cunning. Feeding Yoshi is another multi-play mobile game designed to be woven into one's ongoing everyday life. The game itself took advantage of the wireless infrastructure present in most urban environments, representing open access points as creatures call Yoshis who require feeding and closed access points representing areas that food could be grown, plantations. The aim of the game was to collect seeds, plant them, collect food, and return to a Yoshi feeding it the food in return for points—for more information see Section A.3. In Feeding Yoshi there was little information to be hidden however, in order to see the scoreboard the individual players had to upload their score. Instead of uploading their scores straight away players waited. This meant that they were unable to see the other players' scores—the only way to view the website was to enter a code from the PDA that encoded the score of that player. However, one team decided that its lowest scoring player should login, revealing his score, but not the entire team's score. This enabled them to see how the other teams were progressing. Controlling information in this way allowed the team members to maintain the element of surprise when they uploaded their own massive scores. The idea behind this was so that they could accumulate such a high score that rather than motivate the other team it would dishearten them. While hiding information from other players it also became important to hide information from those who were not players.

In several of the trials the impact of the technology on the users productivity at work could be readily seen. One of the key concerns raised by the trial participants was the affect of any system on their work. However, most felt that as long as their boss did not find out everything would be okay. Indeed during several of the post trial interviews several of the participants stated 'Don't tell the boss!' This was first raised during Feeding Yoshi, where the interweaving of the game into everyday life sometimes affected everyday practices including work. Feeding Yoshi is a mobile multi-player game played over several days. Since, the game was often 'more fun than work' this was occasionally affected by the game, as the following interview extract illustrates.

> *"Erm (laugh), don't tell the bosses but yeah we just basically played the game more than we did work. There were certain points in the day where we sort of thought naah lets just get going, whiz around a bit, get a few more points and do some work when we come back. If there was a point in the day where we thought,*

ah no, we're just fed up of doing this [work], we'd just think right, now we'll go and [play Feeding Yoshi] instead".

Another player also expressed how the game affected everyday life by making her late for work.

"I played on the way to work quite a bit. But it is quite a long way, because it is from Partick right into town. So I got quite a lot of [points]. But some times when I walked it took me ages to get anywhere because I would find a plantation and then I would run back to feed the Yoshii and then I would run back

[One day] I was late for work and [on another occasion] I was late to meet somebody when I [was playing the game]. [I got caught up playing], I just didn't realise what time it was".

During the trial of Shakra, the different roles that the participants fulfilled in their everyday life meant that what was appropriate behaviour for one was not appropriate for another. This is illustrated by the following extract:

"Ewan just rubbed it in front of our noses, how far he went. (Laugh) [He teased us] all the time! I mean, we would be sitting in calls and he would be walking by Holding up the phone [showing how much activity he had done]. Maybe if there was a meeting [at one] side of the building, he would walk [the long way] around the building to get there."

Within this group Ewan was the project leader and therefore 'the boss', this gave him opportunities to increase the activity levels he achieved while others could not. This particular account also illustrates that when they had the chance the users would take advantage of any opportunity they could to get up and try and increase their own activity levels. Taken advantage of particular opportunities, or concealing aspects of oneself and one's activity was extremely important in the games studied— Treasure (Section A.2), Feeding Yoshi (Section A.3), Castles (Section A.4)—as well as the awareness applications—Shakra (Section A.5), Connecto (Section A.6). While it is possible to hide particular elements of oneself or one's activity this can be jeopardised by impressions given-off. These impressions can be given-off through body language or inadvertently from members of 'the team'.

3.4 The Team

So far this chapter has discussed how individuals fulfil several different roles and the main mechanisms for supporting this, hiding and revealing. While individuals construct presentations that are shaped by how they wish to be perceived and the context they find themselves, it is often the case that others must be relied upon to support the performance. In his dramaturgical analogy Goffman referred to these 'co-performers' as 'the team'. The members of the 'team' work together to confirm and maintain the group's façade and the façade of each of the individuals that makes it up. This process can be fraught with danger for each individual, since he/she would not wish to discredit the performance.

In Castles, while there were no constraints put on what the players did or talked about during the trial (except for those programmed into the system), like in any game there was an unwritten rule that outsiders cannot act as informants [68]. In most games, this can lead to serious retribution. Early on in the game players realised that it would be more resourceful to conserve resources if they had any inclination that their opponent had a stronger 'hand'. Rather than committing all of their forces they would use the banter conducted throughout the game to assess the strength of their opponents, and decide whether they would have enough resources to win. This opened up opportunities for bluffing, either to overstate one's own strength to win a battle or to understate it to lure opponents into a trap. In several different battles this tactic was employed, on some occasions the battle would pass without comment while at other times it would become something to be verbalised and revealed to the other players.

On one particular occasion when this tactic was employed the players did not reveal what had just happened, instead they shared several glances, with the victor appearing puzzled by his opponent's lack of resources. This event, although puzzling at first glance, was beneficial for both players. The victor had gained an easy victory and the loser had maintained his resources for his next battle almost certainly ensuring a win, while also maintaining the element of surprise. However, an 'outsider', helping with the deployment of the game, accidentally revealed this information during discussion with the group, by asking,

> *"how come you only sent in [a small number of units]?"*

This was met hastily with a muted response of,

"I'm reserving them [for the next battle]"

This response was also coupled with a dismissive hand waving gesture trying to move the conversation quickly away from this subject, in an attempt to preserve the element of surprise. Unfortunately one of the other players heard this and revealed the implications of having only put a small army into the first battle, stating,

"Ah he's got loads now, nobody expects it... well now we do [John smiles/frowns again]"

He also goes on to note that by revealing this unexpected behaviour, the group will now be more wary when in future battles with the exposed player, which is exactly what he was trying to avoid. This highlights the importance of individuals' control of their own information when trying to convey a particular thing, such as being weak, when in fact they are in a position of strength. While this shows how 'the team' might discredit a performance when individuals do not adhere to their given roles and the status assigned to those roles, 'the team' can be a valuable resource. They can act to confirm claims one makes about oneself, and supporting individuals in maintaining the façade they wish others to perceive. For example, in Feeding Yoshi players drafted in friends and family to prevent their team mates from chastising them for failing to play even when there were times where it was not possible for them to do so—this is discussed further in Chapter 4. Using others to confirm impressions given in this way can be extremely important in producing a credible presentation of self [61] however, impressions are also given-off that are out with the control of the performer and discredit as well as confirm the presentation.

3.5 Impressions given and given off

The banter and physicality embedded in the use of many of the mobile systems presented in Appendix A provided ample opportunity for impressions 'given' and 'given off' to be projected to the audience (see 2.3). Those impressions that are 'given' are intentional and planned, carefully placed to fit in with the goals of a particular user, whether it was to build up useful relationships or bluffing their opponents. The impressions 'given off' are spontaneous and exude from the individual without their control, providing observant opponents with 'reads' or 'tells' on the performer. This intricate pattern of revealing and

concealing was an extremely important part of many of the systems presented in although it was most obvious in the game based experiences presented in Appendix A.

3.5.1 Impressions given

Often in impression management there is a tension between hiding and revealing information. Revealing aspects of oneself can help establish points of commonality with others. Although individuals run the risk of revealing information that might not be well received. Throughout one's life, experience is built up, and therefore one's understanding of different situations can be used to inform what should be revealed. In Treasure, Feeding Yoshi, and Castles this tension played out in an interesting way. Revealing the underlying infrastructure in Treasure provided the players with a shared conversational resource around which they could coordinate their activity. By revealing aspects of their system and strategy in Castles, players could share the game constructing a personalised social experience that was more fun. However in doing so players gave away information about their play, which could cost them a victory. In Feeding Yoshi hiding one's own score from the other players meant that one would not be able to see the scores of others. However, the teams worked out that if the person with the lowest score uploaded their score they would be able to inform the rest of their teammates of the other scores without revealing their own team's score. These examples highlighted a variety of different reasons why hiding and revealing information is important. They also show how hiding and revealing, can facilitate coordination, can be used to bluff, and how it can be used to share things with others. In the earlier sections presented in this chapter the use of hiding and revealing to support multiple personae was presented as well as a discussion of the intricate nature of hiding and revealing particularly when trying to control the impression one gives. A subtle and well-rehearsed method of hiding and revealing is done through the use of bodily orientation.

3.5.1.1 Embodiment

The embodiment and physicality inherent in the design of many of the mobile systems presented in Appendix A provided users with a subtle channel through which they could reveal or conceal information from others Often these physical gestures were aimed at sharing, and coordinating the experience making it more sociable and fun. In several of the experiences the compact form of the devices used—PDAs and mobile phones—made hiding information easier. Through their physical orientation players were able to turn the screens away from other users hiding what was on the screen. In Castles hiding

information was made visible when battling, the players would turn and ‘face up’ to one another. Revealing information by making ones screen visible to others was done predominantly to support and collaborate with others. Treasure players in particular, would use their PDA to coordinate activity with team mates and demonstrate particular game features.

Revealing information could also be very subtle, especially when trying to reveal one was having difficulty. During the Castles trials rather than explicitly ask for help and appear as an incompetent player, users would, shift around in their seat, make unusual facial gestures, and huff and puff. This would slowly build up until it became so noticeable that someone involved in the game would feel obliged to help During one particularly animated example observed during the Castles trials, an individual was faced by a series of resource indicators on–screen; these meant that his buildings did not have enough resources to produce their wares. Rather than ask directly for help, he shuffled in his chair, and made several facial expressions that built up as his frustration grew—see Figure 1. This indicated to others that he was facing a problem. When help finally was given by one of the evaluators, this participant refused to give up his PDA, instead he retained control over it, simultaneously hiding its display from the other players and yet exposing his problem to the evaluator providing the help. After a short discussion about what the indicators meant, he continued with his play. This combination of hiding and revealing selected elements of the game through animating the display with both physically and verbal actions are recurrent features. This ongoing performance within the game seemed to fulfil several different functions. It highlighted areas of confusion but it also provided opportunities to engage with other players.

Figure 1: Physically expressing problems.

Unlike impressions that are 'given off' these actions were explicitly designed to highlight that one was having problems in order to gain help implicitly without asking for it. Punching the air, pointing, and facing up to opponents were all common gestures made to 'annotate' the game and designed to enhance the enjoyment of the experience. In a similar way players would design specific utterances during the game that were aimed at giving false information in order to bluff.

3.5.1.2 Bluffing

During play, players would often talk about the strength of their armies and others' armies, some would understate, while others would exaggerate, the strength of their army. Hiding and revealing information enabled the players to portray weakness where there was strength or vice versa. In Castles it can be seen how players controlled this flow of information through verbal exchanges with others. Hiding and revealing in this way is similar to bluffing in poker and in fact several players likened the game dynamic to that of poker [71]. Joking is another behaviour that enables players to control the flow of information that became standard in Castles. The ambiguity inherent in joking exchanges provided an opportunity for players to hide or reveal information. For example, some of the players mentioned that they had components that were not part of the game such as, the 'Lion School' and the 'Magic Tower'. Often bluffing was a manifestation of joking between the players. Some players would use this technique to overplay their 'hand' displaying an arrogance that made others' think about their strength. Others would underplay their 'hand', displaying modesty to try to lure opponents in, or to limit the potential embarrassment caused by a defeat. Phrases such as *"I don't think it can handle ten thousand!"* and *"I'm gonna lose so bad!"* show how the ongoing banter helped when employing this type of tactic, and how it was possible to reveal and conceal information if done correctly.

In most of the games presented in Appendix A specific moves were developed, such as, the drive by Yoshi, hunters and gatherers in Treasure, and the face-off in Castles. These embodied game based actions could be used to bluff opponents. The physicality afforded by Treasure and the environment in which it was played enabled other users to use the notion of pick pocketing without having the ability to pick pocket. One player in particular noted that he had stood on a mine and therefore was locked out of the game for 30 seconds. He saw a player engaged in a recognisable game 'move', walking around in a regimented stop start manor and felt they were in an area with lots of coins and they were gathering

them. So he decided to chase them pretending that he was going to pick pocket them despite the fact he could not do anything—being locked out of the game. The result of the encounter was that he successfully chased the other player away from a fruitful area of coins thus preventing them from getting further ahead while he could not gather any points. At first this seemed like a rare event however, after further analysis combining video and system logs, this type of activity was shown to be common. This incident highlights two important characteristics of impression management. In the first instance the bluffing player can be seen to design his actions in a particular way and achieves the desired result. However, the victim has not designed their actions explicitly, instead knowledge about what they were doing was given-off as they went around playing the game that was taken advantage of.

3.5.2 Impressions given off

Inferring what others are doing enables individuals to analyse any performance. Ideally the performer wishes to have complete control over their performance to prevent loss of face. However, as has been discussed impressions given off can be used by the audience to credit or discredit the performance depending on whether the information given off shows the performance to be 'genuine' or not. In the pervious example the impressions given off by the victim exposed what they were doing and enabled the bluffer to take advantage of that information. The bluffers carefully constructed performance was given credibility through pervious interactions in the game although if those who were fooled by this tactic had been more observant they would have noticed the subtle difference between those bluffing and those trying to pick pocket for 'real'. This difference was the readiness of the bluffer to click the pick pocket button those not bluffing would have their hand positioned to strike as soon as they felt they had the opportunity.

Over time and through their use of the system individuals became more aware of the impressions that they gave off especially when confronted in public. In Feeding Yoshi strangers would approach players to enquire if they were lost because of the shuttling back and forth required to collect fruit and feed Yoshis. In Shakra users expressed their concern that other users of the system might be able to track their activity. This was possible through the use of the system and understanding of particular circumstances of the tracked individual.

> *"I was checking it in the morning before I went out to see if any of them were up before me… Then I would know if Gary was away to work or if he was away for his lunch, cause it would pick it up. I would [see], Gary [has] like ten minutes this morning and if [that goes up to] thirteen or fourteen I knew he would be on his way back from lunch and things like that … So yeah, you can track them."*

This did concern one individual since he was taking part in the trial with his boss:

> *"The only thing was that I didn't get home till about half past twelve last night. So I clicked into the next day. So I had no way of seeing … they know what time I was getting in at …[if there were people you didn't know], you could see how it may be [used against you]."*

In Castles, elements of the system that were designed to support the users subsequently provided information given-off by their play that was not predicted during the design phase of the system. Users were able glean information from the log data used to generate the recommendations to get a 'read' on their opponents. The following statement made in the post–trial interview shows how one player used the system to obtain an insight into his opponents:

> *"Yeah I just used the [recommendations] to spy on them"*

This extremely resourceful player elaborated on this by saying:

> *"I made a note of [the recommendations received from others] because it gave an indication of what other people might have been building, and then maybe I might be able to counter that".*

Getting a 'read' could also be obtained though the continuous banter and conversational exchanges between the players. In the events that proceeded vignette 1 in Section A.4.4, one particular player, Henry, had been extremely vocal about his activities and even stated *'I'll have you'* as his opening gambit before the battle. While he may have been trying to bluff, Pete was able to read his opponent's comments correctly as a sign of strength and commit only one of his weakest soldiers into battle. As a result, he lost, but by realising that Henry had a much stronger fighting force he was able to conserve his own resources

for later on. In this particular encounter, Pete is chastised by his opponent and teased as a *'coward!'* and he promptly justified his actions. He went into detail, describing his army and why there was no reason to put them into battle just to be killed. He even mentions that he only has 4 men.

> *"I have only got like 4 men what am I going to do anyway? There is no point killing them!"*

However, this account is not entirely honest. Before the battle, he had 16 archers, 2 cannons, 86 peons, 16 swordsmen and enough resources to convert more of his peons into other fighting units. This explanation was crafted to save face, rather than bluff his next opponent. Instead, it is a protest against being called a coward and therefore being thought of as not 'playing fair'. This un-written rule to make a reasonable attempt to win meant that although Henry had won it seemed like a hollow victory. This particular instance is discussed further in the following Chapter 4. In another trial another player also employed this tactic, not because he had a read on his opponent but instead to conserve his forces for one last push to win the final battle. While his opponent saw that he had only put one peon into battle, he did not reveal this information to the group.

3.6 Discussion

The focus of this chapter was to understand how people control the impressions they give to others. Their use of recorded data as well as, other individuals and embodied interaction have been discussed highlighting several important topics. These topics include dynamic roles, appropriate behaviour, 'the team', and impressions given and given-off.

In order to support the fluid transition between different roles individuals had to control the information they presented about their self, hiding some aspects while revealing others as the situation required. This ongoing tailoring of one's own presentation of self was required so that one's behaviour could be seen as being appropriate for the occasion. Occasionally particularly in the games analysed this was difficult with some tactics been seen as 'not playing fair'. In these instances banter acted as a means of holding individuals to account for their actions. There were other instances of in appropriate behaviour being covered up or concealed to prevent any retribution. For example, those players in Feeding Yoshi who had to hide their play from their bosses so that they would not get into trouble about the affect it had on their work.

Being sent be acting appropriately was so important for many of the individuals studied in Appendix A individuals would bring in outside help to support this endeavour. 'The team' often included, friends, family, and work colleagues as well as others involved in the experience. These individuals we used to support individuals in their task. In Feeding Yoshi they were surrogates—discussed further in Chapter 4—and in Shakra they provided motivation. These individuals were used to support any 'claims' made such being a hardworking team mate however, there was always the possibility that they cold discredit a performance either with their insider knowledge, such was the case in Castles.

It is important for individuals to draw on outside influences like this to support the claims they make about themselves however, there are often many channels through which information can be given-off that can also discredit a performance. Most commonly this happens through bodily gestures that reveal that one is lying. In Treasure and Feeding Yoshi, game moves could be identified in a similar way. Throughout the trial of Castles, and Ego it can be seen how information is given-off through the system. In Castles tactics could be inadvertently be revealed in Ego it was areas with significantly high densities of WiFi APs and Bluetooth devices.

3.7 Conclusion

The aim of this chapter was to explore the role of hiding and revealing in impression management. In particular, how this hiding and revealing is done drawing from several uibcomp experiences. These experiences span a multitude of different domains including health, tourism, games, and general awareness sharing. By analysing these areas several topics have been drawn out as significant.

In the previous discussion the need to support dynamic roles was highlighted. In order to support this, designers must provide mechanisms to hide and reveal information; with adequate control of the information being given out individuals can control the impressions they give. While this is an ongoing process it can be further complicated with the addition of recorded data and therefore providing tools to aid this process is imperative.

Another aspect of this process is the significant role that individuals have to play in hiding and revealing information. Family friends and other peers, support individuals in going

about their everyday tasks and in many of the experiences this was no different. While this is not something that can be easily designed for, recognising this to be the case might result in evaluators setting out stricter boundaries at the outset of a trial. It may also be the case, as we have seen, that this produces interesting and previously unforeseen results.

What designers can design explicitly to support is the inclusion of others into supporting and verifying the presentation one makes. We have already seen how this can be done through social networking sites where friends keep others 'in check' [138] by commenting on things that they feel are misrepresentative.

Finally, designers must carefully consider the impact of their technology and provide, where possible, the ability to review any impression management dependant information for review. However, as we have seen in Castles and Ego there will always be new and unforeseen ways in which the technology itself can give-off information about a user that may compromise the desired impressions given to the audience.

In summary, the following lessons or guidelines have been drawn out of this work:

- Support dynamic roles through the tailoring of information
- Enable the inclusion of outsiders to verify the impressions given.
- Designers must consider that their systems may potentially give-off information that might damage the creditability of a performance.

Chapter 4 Accountability

4.1 Introduction

Hiding and revealing are extremely important when trying to present oneself appropriately in different situations. Adapting one's behaviour to the given situation enables individuals to control how others perceive them. Often the reason for adapting one's behaviour is to conform to particular norms that are associated with the situation. If one does not uphold these rules one will be held accountable, often resulting in some form of retribution Accountability, and in particular being held to account for ones actions, supports the build up of knowledge and understanding that enables individuals to be aware of what is, and is not appropriate. This chapter explores the role of peers in learning what is and is not appropriate, the social pressures that require one to behave appropriately, and the different techniques individuals use to produce suitable accounts of their activity.

The aim of this chapter is to explore accountability and how different techniques are used to hold individuals accountable for their actions. The chapter also discusses several important elements of producing accounts for ones actions that can often be implicit as well as explicitly designed.

4.2 Role of Peers

One's actions may be held to account at any point and therefore individuals must continually adapt their performance, although creating such accounts is something that is often done implicitly. This adaptation is influenced by one's understanding of the world and through the knowledge built up whilst inhabiting it. An individual's family and friends are imperative in this process; from early in life we are taught the difference between right and wrong so that we do not break social protocols. These social protocols are negotiated and change over time, with particular behaviour becoming inappropriate and other behaviour becoming appropriate. When in new, unfamiliar, situations one's peers are a valuable resource for learning what is appropriate. They can provide guidance implicitly through our awareness of how they act, or explicitly by telling us how we should behave. Often this explicit notification of how one should behave can be the result of inappropriate behaviour being held to account.

4.2.1 Behaviour made appropriate

Everyday social protocols are bound up in our actions with and in the company of our peers. If one does not adhere to these social protocols one may become the subject of retribution (see Section 7.1.4.4). The level of retribution is dependent on the severity of the breach of these protocols. An eloquent example of how everyday social protocols come into play in new situations could be seen during the trial of Shakra. While the users of Shakra could in theory observe and compare the activity levels of any of the users, some felt that it was only appropriate for them to see their own group's activity. Indeed, one player from Group 3 explicitly stated that she felt uneasy about looking at other individuals' activity levels, as she did not have the right to do so. She stated:

> *"I would only look at the activity levels of certain members"*

While this was not something that was regularly reported from the players, it could be seen through their use of Shakra that they only compared and viewed the activity levels of those within their group. Whether consciously or subconsciously, this serves as an example of how social norms are adhered to. This becomes more apparent as mechanisms that report one's actions are introduced and therefore increase the likelihood that one might be asked to account for those actions.

Connecto is an awareness system that was given to users to provide them with awareness of one another's activities—see A.6. The participants' eagerness to express how they were 'stuck in traffic', rather than driving, or at a 'boring accounting lecture', revealed a need to tell a story rather than merely providing facts. However, since the system was different to any other application they had used before a set of norms or conventions to be adhered to had not been established. Through their use of the system, the players negotiated with one another pushing the boundaries to see what was acceptable. The comments they made to one another show how this process evolved utilising other communication technologies in conjunction with the Connecto application. For example, one player set his profile to 'Horny', and one of the other group members sent him an SMS back stating:

> *"I can't believe you put that".*

This comment established a precedent and from this moment on other participants began to use more unconventional and extreme location or profile labels. When asked why they

enjoyed reciprocating each other's 'extreme' location or profile labels, another participant explained:

> *"So I guess once one person started doing it, everybody else thought they would follow suit, changing their profile from saying, 'normal' to 'abnormal' etc.".*

Repeatedly the participants were observed trying to express more than just location through Connecto, not only through more elaborate descriptions of situations but also by expressing opinions or calling for attention. For example, one participant took his phone to Amsterdam, and while walking around in the red-light district he set his profile to 'on the job' (a euphemism for having sex). When asked why in the interview, he explained

> *"[I set my location to] 'red light district' and I put my profile as 'on the job' and [one of the other users] who was [in the University] doing some course work showed it to most of the people on my course so they all had a good laugh."*

The location label he had set had been clearly designed for his friends, who knew where he was and had a common understanding of what Amsterdam meant. One of the other players then showed this to the other members of his class. While in this case there was no loss of face, this type of interaction can be damaging since the presenter is unaware of this new audience.

As shown in Section 3.3, work played a significant part in Feeding Yoshi and indeed had an impact on many of the experiences presented in Appendix A. Due to work commitments players were just unable to play, although being harassed by teammates sometimes meant they played and were late for work or they tried to play during work where possible, provided their boss did not find out. There were other occasions that meant players could not play. For example a member of Glasgow2 (see A.1.3) reported,

> *"At the end of the week [I didn't play much] but that was just because I was busy [travelling though to see my boyfriend]. I did give it to [my flatmate] for a couple of days though, 'cause [my team mate] kept phoning me and saying we need to keep up, we need to beat them".*

This particular player's boyfriend worked away during the week and the only time they were able to spend time together was at the weekends. This meant that she would have to play when she was away, taking time away from her boyfriend. This in itself would have probably have been enough to appease her team mates however, she also tried to ensure that someone was still able to play in her absence. Being able to produce a suitable explanation was imperative in Feeding Yoshi, especially if one was not seen to be adhering to their role within the team. In impression management creating accounts that make things explainable is very important, these accounts may be to cover up something that if revealed, may be problematic. It may be the case that these accounts explain what 'actually' occurred in a situation to clarify others interpretations. Therefore, system inaccuracy of software systems can be used to create accounts that hide particular things or it may be the case that individuals must explain what actually happened as opposed to how the system reported it.

These examples illustrate the role of peers in the negotiation in group conventions and norms, peer pressure is often a mechanisms used when holding individuals to account to enforce that they conform to these group values.

4.2.2 Peer Pressure

Pressure from peers can be designed to encourage or harass individuals into conforming to their group's conventions. In Shakra users encouraged others to increase their activity levels. However, even although Shakra was not a game the competitive nature of achieving more activity than others drove individuals to exercise more frequently. Support and competition like this is extremely common in team games and team members who do not 'pull their weight' are likely to be chastised by the remaining members of the team. This was illustrated in Feeding Yoshi when several self-proclaimed 'team leaders' harassed team mates into playing. However, some of these team leaders did not always feel comfortable in this role:

> *"I suppose I was the team leader because I got everyone together; but I know Dan and Phil are very busy because they're preparing for a big event so I didn't want to keep putting a lot of pressure on them. Although I think I should have [put a little more pressure on them] or at least rang them on Monday to remind them to upload their scores. Or done something. It didn't help that I went away either, but still they were on email. I though that when I saw Dan getting into it on the Wednesday, that*

would be it and he'd be away with it. I felt a little bit guilty [because] I didn't want to be cracking the whip, saying you've gotta get on with it."

The players, particularly in Feeding Yoshi, developed several different strategies to appease their team mates. Firstly they would try and make their inability to play explainable. This is partly illustrated in the previous quote and is further discussed 4.3.1 below. The second and most used strategy in Feeding Yoshi was the use of 'surrogates'. This involved including family and friends, who played in place of the 'official' players to prevent playing time being lost.

4.2.3 Support of the team

In Feeding Yoshi the aim of bringing in outsiders to play was to ensure that points were being collected throughout the day. How these individuals were recruited and the roles they took developed differently. First was the role of the 'co-carer', these individuals were brought in to share the game so that players could involve their family and friends and therefore play when they were supposed to be spending time with them. Secondly was the role of the 'baby-sitter', these individuals were brought in to 'take care' of the game while the player could not play. For example, while at work, points could still be gained by giving it to a trusted friend or family member to play, and look after, while they were engaged in other activities.

This is similar to those who are trusted with children, and in the same way 'co-carers' would gradually progress to 'baby-sitters' as trust and competency grew. It would often be the case that players would include others in their play allowing them to shadow them and then take over, while still being supervised, when they knew the game well enough. Once they felt that these individuals could be trusted to 'look after' the game, they were left in charge when the player was away. A flatmate of a member of the Glasgow2 team fulfilled both of these roles. She reports how this process began

"My flatmate was interested in what I was doing so we went and played for a bit. For about half an hour, an hour (pause) that was Wednesday".

This shared experience through the 'co-carer' role was something that was seen on several occasions with a player from the Nottingham team reporting a relative as the 'co-carer' during her visit home to see family:

> *"I went to visit my sister. On the first day that I arrived in Norwich, we went out just to play Yoshi. We played it together. We spent about an hour wandering around the houses near here. So we did that just as something fun to do and then the same thing on Sunday when I was at my mum's house. We went out just to play Yoshi".*

Indeed in several instances the 'co-carer' developed into the 'baby-sitter'. The player from Glasgow2 reported that her flatmate went from being a 'co-carer' to a 'baby-sitter' as a result of her needing to spend time with a loved one. Her boyfriend worked away and they only got to see one another at weekends when he travelled home or when she visited him. This presented her with a dilemma: play the game and lose out on valuable time spent with her boyfriend, or spend time with her boyfriend and lose out on valuable points for her team and therefore suffer the wrath of her team-mates.

While some may have seen this as being outside of the rules, it was never stated that players could not get surrogates to play when they could not. This inclusion of other friends and family whom an individual shares close relationships with can be seen regularly throughout our lives. Also, when managing a group's façade [68], in this case a team playing Yoshi, it is important that all the individuals play, or at least appear to play, their role in this collective presentation—one of a highly motivated team. This may have been a performance designed for other teams so that they could be seen as being the best but it may also have been a performance designed for the evaluators to show individuals as being a 'good' trial participant. By introducing surrogates, players were able to overcome problems such as being pressured by their team-mates into playing when they were unable to.

When 'baby-sitting' the flatmate of the Glasgow2 player talked about the game as if it were a pet, taking it for walks and feeding Yoshis fruit to gain valuable points for the team. The team from Derby reported a similar experience, when one of its members went on holiday and, rather than let her PDA 'fall out' of the game, her team-mate decided to take over the 'care' of her PDA and continued playing with both their PDAs.

> *"Officially, [my PDA] was 4th, but I took over Kerry's PDA when she went away on holiday. So if you combine my score on both, I think I'd have come about 2nd".*

These different instances where individuals were occupied with things that hindered their progress in the game show how people utilise their support network of family and friends to facilitate them in maintaining the impression they wish to give. Those who are 'outsiders', brought in by the users, can have a profound effect on how individuals change their behaviour. Already we have seen how individuals worked to hide aspects of their activity from their boss but they can also provide motivation.

4.3 Adaptation

Feedback and control are fundamental to supporting adaptation in impression management. Control mechanisms such as hiding and revealing—see Chapter 3—provide users with the ability to adapt and tailor the information they give out. Feedback mechanisms are imperative if individuals are to reflect on the impressions they give and give off to others to inform the decision over what should be hidden or revealed. Reflection then informs users' subsequent performances so that they do not break with social protocols. Throughout the studies described in Appendix A there were several different mechanisms for reflecting on ones actions, used by the participants. These are, self reflection—reflecting on one's own activities, comparison to others—directly comparing one's own actions against those of another, and seeing oneself from the perspective of another—this can be done in many different ways but is readily supported by technology, through recorded data such as video. Each of which will be discussed in due course.

4.3.1 Behavioural Change

To support behavioural change sufficient feedback is required; it may come directly from peers, through talk and banter, or indirectly through body language and the impressions given off from the audience. This feedback provides individuals with the resources through which they can reflect on the presentations they give and support compressions made between their actual self and their idealised notion of self. If such reflection is not facilitated in a timely fashion misrepresentation and inappropriate presentations can be made. This is often the case when presenting ones self digitally where the opportunity to react to the audience can be hampered by the separation over both time and space.

Shakra, an activity awareness tool, supported reflection in various ways. Self-reflection was supported by enabling individuals to compare their past activity with their current activity. Direct comparisons to others were supported by enabling individuals to share

information with friends therefore enabled them to compare themselves against one another.

People often have an idealised notion of self that they try to adhere to, and they present themselves accordingly. This idealised self guides what is shown to the audience (see 2.3.2). Throughout our everyday lives, we are continuously adapting our opinion of what our idealised self should be. This adaptation is often facilitated by mass media where, for example, images of footballers and models are continuously being touted as the idealised human form. Similarly, fashion and political views are influenced by the mass media. Whilst peoples' opinions change over time, their own notion of self may be left behind languishing in their youth when weight or fitness was not an issue. This can result in people becoming detached from what they think they can do and what their actual capabilities are. For example, individuals often feel that they can run the next marathon because they have done it in the past, even if that was several years before. Whilst this is common, this is different from deliberately misrepresenting oneself. Instead people are reluctant to admit to themselves that they are no longer as fit as they once were and often are unaware that their presentation is inaccurate.

Shakra itself acted as a mirror (see 7.1.4.2) in which one could reflect on oneself and adapt as required. While it is impossible to determine in such a short time scale whether this adaptation happened in a deep and lasting way, it can be seen through the users' comments that Shakra helped them reflect on their own activity levels. It is through these interactions with the world and reflecting upon them that one's idealised self can be confronted and re-evaluated. In Shakra this did occur (at least in the short term) with players seeing how little exercise they did and being motivated into increasing this. The following extract illustrates this fact,

> *"[I did walk more than usual], I think sort of subconsciously you [are more] aware of it. I mean, even in the morning, I would normally be going to the bus stop right outside the train station, [then I started] walking five minutes to go up to the next stop, one morning I even [went] to the next stop further than that. It just makes you a bit more aware of what is going on".*

Confronting this can support behavioural change but it is also important for presenting oneself appropriately. Being aware of how one is being perceived by others is imperative

when trying to manage the impression one gives. Shakra acted as reflective material through which individuals could have their idea of self credited or discredited supporting them in changing and hopefully preventing them from being held to account for miss representing themselves which may have caused significant embarrassment.

4.3.2 Facilitating Appropriation

Increased exposure to particular situations can provide invaluable experience and build a deeper understanding of the situation. In such circumstances one is able to reflect and interactively tailor the impressions given. In Treasure this was provided by giving the players the opportunity to play multiple times. In Feeding Yoshi, Shakra, and Connecto this was supported by longer-term interactions.

The historical features in Treasure, Castles, and Shakra provided the users with information upon which to reflect on the experience and the presentations they conveyed to others. The technical support for historical information in Treasure was predominantly used to aid understanding. In particular understanding of wireless networks which, as shown, aid players in the modification of their tactics. While the history of use was exposed thought the collaborative map, Treasure did not provide explicit technical resources for players to directly reflect upon themselves and their play (see A.2 and **Chapter 7**). However, reflection about game play and the subsequent changes of play were still observed. Through multiple plays, players were able to reflect on their own experience and share the results of this reflection with their team-mates. In Shakra, individuals used the system much more explicitly to reflect upon themselves.

While it is important to provide users with the ability to reflect upon themselves to facilitate behavioural change and self-presentation, it is also imperative in supporting the process of appropriation. By revealing the underlying infrastructure and allowing longer term interaction with the system users were able to build up their understanding of the system and appropriate it. This is illustrated during the numerous interactions where individuals used the knowledge built up to bluff. For users, reflection is imperative for their understanding and subsequent appropriation of something. Gaining feedback of how one's own impression is being received is inherent to our adapting and changing, of not only our appearance but also our behaviour.

4.4 Misrepresentation

In Chapter 2, two key features of digitising information were discussed, namely transience and reach. Shifting the context in which information is viewed can change how others interpret it, particularly due to the finite nature of recording information. When the context is only partially captured and shifted, misrepresentations are common. Whenever a presentation of oneself is made it is held to account by individuals who judge its credibility. However, the explainability that is available in synchronous communication is made more difficult in situations where the communication is asynchronous. Technological ambiguity can provide individuals with reason that can be used to explain any misrepresentation however, if the technical ambiguities are not commonly knowledge doubt will be cast on the explanation.

4.4.1 Technological misrepresentation

In Shakra technological misrepresentation proved to be one of the main causes of concern for the participants. The users highlighted that the system made them appear less active than they actually were, this was the result of the cell tower based activity tracking. This prevented 'stationary' exercise from being captured. Several of the players noted this stating that the application did not show gym based exercise, and one player noted it did not include his weekly football game since he could not carry the phone on his person while playing. Another user stressed that this may have caused a problem if he was more conscious of his body image stating:

> *"… the way I look at it would be that you can walk for half an hour but then again if you go on the treadmill for an hour you probably get more exercise. In that sense I don't think it represent the whole picture of how much exercise you actually do… [This] didn't really bother me… I am not that conscious of [people seeing] how much exercise I do. I suppose thought, if I was overweight or whatever, I might have had an issue, but it doesn't really bother me that much".*

Another user of Shakra noted,

> *"[I felt that the system represented my activity but] usually I am a more active. The fact that we are busy with the opening of a new centre [meant I wasn't as able to exercise as much as normal]… but it represents what I did over the last week."*

This second quote highlights the problem of taking information and presenting it out of context. Without looking at the bigger picture this individual may have been perceived as being lazy or unfit. It is for this reason that in Chapter 2 the author advocates Chalmer's historical view of context [22].

In Shakra individuals also tried to blame system inaccuracy for them not achieving high activity ratings. Blaming system inaccuracy is an easy way to refute the image of oneself however, out with the previously mentioned system limitation, users reported that the system captured what they did very accurately. This discredited the claims of those blaming system inaccuracy rather than their inactivity, and subsequently the other users refuted this explanation for them appearing inactive. For example, family and friends, during conversation, confirmed that the system was showing an accurate picture of the individual by discrediting these excuses.

> *"I was speaking to my sister and I said I thought I was more active than that and she said: 'come on, who are you trying to fool' "*

Making our actions explainable underpins accountability. While individuals often do it subconsciously based on previous experience, following the norms and conventions put in place, if asked to account or explain their actions they must be able to do so. Problems arise when misrepresentations are made and there is no way for the misrepresented party to explain or give an account of the representation presented.

During the trials of Connecto the users were asked specifically about privacy, and misrepresentation, with most stating that the system addressed most of their fears. The main aspect that they highlighted was the fact that they had control over which locations were marked and shown to others. However, the difficulty in providing an accurate cellular positioning system inadvertently introduced an ambiguity in positioning that could be used in conversations to refute any claims that one was at a particular location. Instead users could claim it was system inaccuracy to explain away any uncomfortable or compromising information that might have seen them called to account.

While systems may misrepresent users in this way constraints implemented by designers also force users into misrepresenting themselves. For example in, most MMPOGs and social networking sites, players are restricted by the categories they can choose to describe

themselves. In [48] one player particularly resented being forced to describe himself as bald because their was no checkbox for shaved head, in the description of hair. In such cases users are forced into giving inaccurate presentations of self that are not explainable or at least the opportunity for explaining one's inaccurate presentation is hampered. For example the dating site user may have an opportunity to explain why he chose this option in a face-to-face meeting that will satisfy the other party however, he may never get the opportunity. This explanation may be prevented with him being filtered out by the advanced searches of other users—shaved might be a suitable category for them but not bald. This section has discussed how system constraints enforced on users and inaccuracy in the technology can lead to misrepresentations in self-presentation applications, resulting in the misrepresented party becoming the subject of retribution. Depending on the severity of the inappropriate behaviour will depend on the type of retribution suffered.

4.4.2 Retribution

Retribution can take a variety of forms and can be administered in a serious or playful way. In Feeding Yoshi, like most games, implicit rules built up during the course of play, that if broken would lead to some sort of retribution. The most notable was that players felt teammates should make a significant effort into helping their team's cumulative score. If this obligation were not met players would harass those not playing, calling and sending SMS messages. Occasionally players reported their annoyance with teammates for not fulfilling this obligation although in general this was playful in nature.

Banter and discussion often acted as an opportunity for players and users of many of the systems presented in Appendix A to hold other players to account. In Castles this could be witnessed predominately during the battles where most of the banter that surrounded the game was conducted. This is illustrated through the following extract:

> *Henry: I'll have you*
> *Pete: Oh good fighting*
> *…*
> *Pete: There's a tactic for you I'm actually battling you with one villager with a stick*
>
> *Pete: [after the battle] oh I lost*
> *Henry: You coward*

Philip: He is saving all of his stuff for the last battle

Henry: Coward

Pete: I have only got like four men what am I gonna do anyway there is no point killing them

Henry: Why didn't you build more army?

Pete: I have got no men. [Receives a new component] Ah spear school!

This conversation shows two players preparing for a battle against one another. During the initial exchange the players posture and state how they might line up. In the final section of the extract the battle has finished and the winner (Henry) realises that the army that was chosen by Pete was extremely small—one peon. Although this was a valid tactic to prevent one's army from being wiped out it was seen in this instance as not playing by the rules. The teasing that preceded the battle by Henry on Pete shows that he was unsatisfied by the outcome because he could not show his strength, and in some way he felt Pete had gained the upper hand. This playful retribution resulted in Pete feeling the need to try and explain his actions by stating that there was no point in having all his units wiped out because he only had a small number. In fact he had a very strong army but had gained a sufficient enough 'read' on Henry that prevent them from being wiped out.

The threat of retribution can prevent individuals behaving in particular ways and it is also imperative for successful socialisation. With regard to games even in-game actions can be held to account out-of-game and vice versa—see Chapter 7. As children we must be told off to learn the right from wrong and peers must be informed when their behaviour is inappropriate. Retribution provides important feedback in the socialisation cycle that informs individuals and enables them to reflect on their behaviour to make sure it is appropriate.

4.5 Discussion

Throughout many of the experiences discussed in Appendix A several different techniques for holding individuals accountable for their actions were employed by the users. In Feeding Yoshi it was peer pressure; players were chastised if they did not 'pull their weight' and were often harassed by team mates into playing more. In Castles those adjudged not to have played by the rules were teased through ongoing conversational

exchanges and banter shared between the players. Inappropriate tags created in Connecto were highlighted and subsequently re-designed to be more appropriate for the audience. It is also the case that in-game actions might be held to account outside of the game and *vice versa*, as discussed in Chapter 7.

The significance of feedback and in particular reflection can be seen. Throughout this chapter self-reflection, the use of others as reflective material to make comparisons from, and the ability to see oneself as others do have been discussed. These are extremely valuable and important resources from which individuals can compare and adapt the presentations they give to ensure they fit with the appropriate context. When feedback is not provided, one's idealised notion of self can become out of sync with how others perceive one. Providing feedback to bring ones idealised notion of self into alignment with ones actual self can motivate individuals into making significant changes in their behaviour. In Shakra, presenting individuals with their levels of activity made some reflect on how little they they did and they increased the amount of activity they did.

Feedback is also imperative when trying to prevent or rectify any misrepresentations, particularly when digital presentations are made in the absence of the presenter. In these situations timely explanation and adaptation cannot be made therefore significant damage to the impression one wishes to give might be done. In these situations designers should aim to provide individuals with a means to tailor this information when the presenter is absent. Having presentations that best fit the appropriate audience are less likely to cause undue embarrassment. Otherwise individuals will be forced into an all or nothing approach where their information is made public or private reducing the individuality of self-presentation.

Ambiguity can also be used as a resource for making ones actions explainable. While system designers often design for systems that are extremely accurate, users often take advantage of these inaccuracies and appropriate them for their own means. In particular individuals can use them to explain away any information presented that they wished to be kept private.

4.6 Conclusion

The aim of this chapter was to explore accountability and impression management. Specifically this chapter aimed at highlighting the different reasons why individuals are

held to account and the various ways individuals construct particular accounts. These issues have been explored through studying several of the systems presented in Appendix A.

Again this chapter highlighted the importance of others to impression management. They are used as reflective material who provide feedback to the presenter. This supports the evaluation and adaptation of one's performance over time, enabling individuals to tailor the performance they give making it appropriate for the situation one finds oneself. Others are also used as a support network enabling individuals to uphold the façade they try to create. In this Chapter this was shown through the analysis of Feeding Yoshi where individuals made use of family and friends so that play continued even when the participants were otherwise occupied.

While accountability helps maintain that individuals behave appropriately this also adapts and changes over time, this was shown in the study of Connecto. Users pushed the boundaries to establish what was acceptable within their groups by creating outrageous tags. Initially others were shocked but quickly began trying to create their own controversial tags to amuse the other users. This negotiation of what is and is not appropriate is completely dependent on the group and when one steps over the mark they may be held to account as seen in Chapter 7.

Misrepresentation is something that can be very damaging when trying to present oneself to others. In face-to-face communications misrepresentations can be explained or clarified in a timely fashion. However, when communication is asynchronous this timely intervention is not possible. This is often a problem when presenting oneself through technology and in particular on social networking sites. Individuals must have appropriate feedback and control to adapt and change the impression they give. In the previous chapter hiding and revealing have been shown as being important control mechanisms to try and prevent misrepresentations. In this chapter the author has tried to focus on how individuals make misrepresentations explainable. Supporting this can aid individuals in hiding information inadvertently revealed by a system or to clarify any misinterpretation of information presented about oneself

In summary, we offer the following lessons or guidelines from this section:

- Support reflection based on the impressions given.

- Support ongoing negotiation of what is considered appropriate.
- Provide individuals with mechanisms that support explainability.

Chapter 5 Designing for Impression Management

In this chapter, the author presents a framework for designing to support impression management. Throughout the thesis the author has shown how individuals try to present themselves through the technologies they have in their everyday lives. However, many of these systems do not support the important issues regarding impression management. The framework presented in this chapter aims to illustrate the key areas in impression management and highlight the areas in which designers should concentrate their efforts. This section will begin with a discussion of the main issues discovered so far in the thesis, before presenting the framework and a set of guidelines that designers should follow if they wish to explicitly support impression management. The section concludes with a summary of proposed future work.

5.1 Discussion

Throughout this thesis aspects of impression management have been discussed. From early in Chapter 2 ideas that are extremely influential to impression management have been brought to the fore, such as Goffman's dramaturgical analogy for impression management and face-to-face communication. This discussion aims to draw out some of the key design considerations that must be made when designing for impression management.

Throughout our everyday lives we act appropriately based on the situation we find ourselves in. Understanding the context one finds oneself in is imperative to this, and is built up through experience. This thesis has recognised this and discussed context at length and how it relies on awareness to provide any performer with the necessary information from which they can construct an appropriate presentation of self. As the context one finds oneself in changes, so does the performance given, adapting appropriately to meet the new requirements of the situation. In A.2 the importance of revealing the underlying infrastructure of a system when trying to support this type of appropriation is shown. Also in 6.4, Domino, a component based architecture for supporting system adaptation was presented. These concepts have been discussed at length from both, sociological and technological viewpoints throughout the thesis.

The author has also discussed several models for context-aware systems Chapter 2 and the issues that arise when trying to capture context [76]. The historical view of context advocated by Chalmers has been used in several of the systems presented including,

George Square (recommender), Castles (component recommender), and Ego (tailored presentation). This historical view of context is important when considering supporting a shared understanding. Since understanding is built up through experience, history is extremely important. It is the accumulation of our moment-by-moment interactions that enable us to build this understanding and share it with others. Even in Section A.6 where only the moment-by-moment state of the users was presented, with no view of past activity supported, the users felt compelled to check on their friends' activity so that they could be kept up-to-date. This meant that they could interpret the happenings of others in a greater historical context and make educated judgements about what others were doing, in ways that otherwise they would not have been able to do.

Being aware of the context one is presenting oneself in is very important because it can provide a multitude of cues that confirm to the presenter whether his performance is being well received or not. In face-to-face communication this might include facial expressions or body gestures as well as the surrounding area in which the presentation is set. These situations have become second nature to most, with individuals being able to fluidly adapt their presentation by reflecting on feedback from the audience. However, while these situations can be characterised by their immediacy and embodiment, in today's world presentations of self are not confined to such environments. Instead presentations of self may be made while disconnected from the audience over space and/or time. For example, instant messaging clients or social networking sites enable asynchronous communication at a distance. In these environments the common cues that are so regularly attended to in face-to-face communication are lost and therefore presenters have fewer resources through which to confirm that their presentation is appropriate. This in turn hampers a presenter's ability to dynamically adapt his/her performance to prevent any serious loss of face.

Feedback is therefore an extremely important aspect when it comes to managing one's presentation of self. By providing feedback that reflects the audience's reactions a presenter can adapt the current presentation, during synchronous communication, or use it to adapt future presentations. The latter 'after the event' adaptation is the only form of adaptation typically available during asynchronous communication. Feedback about one's presentation of self is always useful, however feedback 'after the event' prevents one dynamically adapting one's performance as it is being given. This can prevent misrepresentations being rectified in a timely fashion and therefore result in a serious loss of face. However, as the author has shown, it is possible to use technology to provide this

dynamic tailoring based on the needs and interests of the audience when an asynchronous presentation is made. This mechanism is similar to how individuals present themselves in everyday face-to-face communication so it would seem ideal to support this in online and digital presentations of self. While this does not guarantee that misrepresentations will not be made it opens up opportunities to present oneself to others in an appropriate way based on their similarity of interests. Since it is impossible to guarantee that misrepresentations will never be made by such a system, providing timely feedback about presentations made and supporting the necessary ambiguity as stated in Section A.6 can help make such misrepresentations explainable.

It is also important to note that privacy is still of concern in such situations. However, by providing appropriate feedback standard social conventions can be used to hold individuals accountable for any misbehaviour (see A.5). Relying on this type of mechanism may not be appropriate when sensitive information is being presented however, when information, which if exposed, would not result in a serious loss of face is being presented this might be a suitable choice. By providing sufficient feedback and control, along with automatic tailoring of asynchronous presentations, it is hoped that misrepresentations will be reduced. Explicit control over who has access to particular information can be used to prevent particular individuals from being presented with sensitive information and can also be used to drive automatically tailored presentations. In Chapter 7 presentations were also made in the moment, so that overtime if no user input was provided either explicitly or implicitly through logging or tracking, the presentations would die away. By controlling how far a presentation might span and how long it might last the author has tried to address the problems highlighted by Grudin. Other methods of addressing the issue of longevity and reach of self-presentation through this thesis is discussed in A.3, in particular epidemic algorithms. These can be used to control how wide spread a presentation might become and also the length of time for which it will be available to the audience.

While privacy seemed to be a concern of the users of Shakra, when privacy mechanisms were introduced in Ego these were not used. Instead the players reported feeling secure in the fact they had sufficient control over what was being logged that they had no need to hide anything. However, a more complex method to hide information was used, ‘hidden talk’. This was talk focused on the game conducted over ‘out-of-game’ channels such as SMS, social networking sites, and the telephone. This ‘out-of-game’ talk often enabled the players to say what they were ‘really thinking’ to one another and strategise. On several

occasions this saw players scheme up plans so that they could win and often these plans would have been seen as ‘not playing by the rules’. The accountability introduced by the public display of players actions made them think much more about how they constructed the static elements of their profile in Ego and therefore ‘hidden talk’ enabled them to be ‘themselves’ without fear of retribution—this was similar to the recipient design observed in A.6.

In Chapter 2 the author discussed the PoliTeam group of individuals working within the German government. This group of people were split across two departments and eventually moved to different offices in different cities. Since they no longer had to see one another, face-to-face, each day they were no longer held to account for their actions even although it hampered the working practices of the other groups. While in this example the groups did not appear to be intentionally hiding information from one another their disconnection—in the same way as the ‘hidden talk’ was disconnected from the public game space in Ego—prevented them from being held accountable for their actions. Another example of this is discussed in Chapter 2 where those who used online dating sites were unable to over embellish or lie about aspects of themselves on their profiles for fear of being found out when they eventually met their date. This type of behaviour could also be seen in several of the system trials presented in this thesis. Such as in A.3 where players decided not to play in particular areas because they would appear to be acting conspicuously. In Ego a type of moral order evolved making it acceptable to give points to or take points away from particular players. These examples highlight the importance of accountability and how it influences the actions of individuals. Before outlining the framework and specific guidelines for supporting impression management it is important to establish what the working definition of impression management is in this context.

5.2 Working Definition

Generally impression management is the process through which people try to influence the impressions that others have about them. In particular, impression management focuses on the flow of information between a performer and his/her audience, with control over what is presented to whom being of the utmost importance when trying to create the appropriate impression.

As the author has shown throughout the thesis contextuality and shared understanding are two of the most important aspects of impression management. The context one finds

oneself in drives any presentation given, drawing from a shared knowledge based, built up over time, on of what is appropriate and what is not appropriate behaviour in any given setting. It is also important to note that this process is ongoing, and continually evolving, thus making it extremely difficult to design for, since the needs of a user one day may be completely different for the same user on another day.

Also, since impression management is inherently reliant on context it makes the control of information presented imperative if one wishes to control the impression given to others. This might involve hiding and revealing information, as and when one needs to, however, other more subtle mechanisms such as ambiguity help individuals explain situations in ways that are appropriate to the current audience. These mechanisms are extremely important when supporting multiple personae and the fluid transition between them needed when individuals move between the different groups they often associate themselves with and interact with— such as family, friends and colleagues.

5.3 Supporting Impression Management

This section will outline the challenges that the author has faced through out the design and implementation of the systems presented in this thesis. These challenges lead to the construction of a design framework for those wishing to explicitly support impression management in their systems. This section considers several different elements of impression management, outlines the important areas to consider, and lays out a set of guidelines, to support the design of such systems.

5.3.1 The Challenges to Supporting Impression Management

Throughout this thesis the author has also shown the lengths at which participants will go to, in order to construct and dynamically update their presentations of self. However, there are several challenges that must be addressed when trying to design to support individuals in managing the impressions they give to others Designing to support unanticipated use is one of the key challenges, as shown in A.3. Impression management is not something that is an individual endeavour. Instead it requires a complex network of individuals who can help maintain and confirm the presentation being given. Supporting these complex networks can be difficult, however recognising that they exist and by designing to support unanticipated use, can help the integration of these individuals into the experience if required by users. This also highlights that while technology offers new and novel ways in which to present oneself it must be integrated into an already vast array of different media

through which individuals present themselves to others already. Therefore system designers must realise that any system designed to support impression management is merely another tool in a complex web of artefacts used throughout our everyday lives to facilitate this endeavour.

In the previous discussion section the ongoing continuous nature of self-presentation was highlighted, with individuals weaving technology and other media into their everyday lives in order to support the impressions they try to project to others. Again this introduces significant challenges for those designing for impression management. Since impression management inherently relies on the outside world to draw material from, systems should be designed to support this and must not be closed off. Instead it is imperative that information drawn from the 'outside' physical world can be incorporated into digital presentations. This is important because as has been shown in A.3 when systems do not facilitate users in drawing from their experiences in both the physical and digital world they work hard to capture this activity so that it may be incorporated into future presentations. Such systems must also provide enough flexibility so that they can adapt and change (automatically or at the users request) to users needs enabling presentations of self to evolve, as the situation requires. This reduces the effort that individuals must go to create an appropriate presentation of self or enables them to concentrate their effort in other areas.

The use of traditional media alongside technology can be seen throughout everyday life. Body language and facial expressions are also extremely important aspects of impression management often lost by the asynchronous nature of the communication or the physical distance between those communicating. In Section A.4.4 players could be seen using body language and gestures along side the technology to obtain help, express emotion or to coordinate activity. While our embodied face-to-face interactions enable us to evolve our presentation in a fluid manner as the situation requires digital and in particularly online presentations have, as yet, not facilitated the same fluidity of presentation. The inherent coupling of context and presentation can make such disembodied interactions problematic. This can be compounded even further with asynchronous presentations of self, about which, an individual will be unsure of a number of important factors including, who is viewing the presentation, what are they focusing on, where are they viewing it, and when they are looking at it. These are the four key elements of context as defined by Dey & Abowd [35].

Also in everyday face-to-face interaction it is commonly the case that individuals take on a variety of roles or personae, some of which may conflict but through the use of time and space individuals are able to separate particular presentations of self. However, as the thesis has highlighted when presenting oneself digitally the boundaries between personae are often lost. Instead individuals can leave behind webpages and the like, as a presentation of self when they are not there. It has been shown how this can be extremely problematic and can often lead to individuals being misrepresented or not presenting themselves as they would wish for a particular audience. The Egor presentation framework (see 6.5) was designed to support this need for changing presentation so that multiple personae could be maintained. It is important to note that the Egor framework, while it provides automatically tailored presentations based on the audience, it does so with the users as part of the decision making process. For example in Ego, users were explicitly able to hide and reveal aspects of their activity as they felt it appropriate from whichever individuals they wished. The path-based algorithm was then able to use this information to construct an appropriate presentation.

While Egor took a historical view of context to decide on what should be presented to whom, Connecto also highlighted how state information could also be used to present oneself in a particular way. Presenting oneself in this way could prove to be problematic since it is difficult for an audience to place the events they are witnessing in context without continual monitoring. However, it did provide those presenting themselves with the necessary ambiguity to hide and reveal the activity. This brings the importance of accountability to the fore and is another important aspect that designers must seriously consider as it can be used to help individuals confirm that the presentations they give are in fact genuine.

5.3.2 Considerations when designing for impression management

Taking these challenges into account and drawing from the earlier discussion the following issues must be considered when designing for impression management. **Feedback and control** as discussed by Bellotti and Sellen has proven to be of the utmost of importance. Reflection based on the reactions of the audience is inherently reliant on their feedback. Subsequently performers are able to adapt and change their performances as the situation suits. It is important to consider privacy in impression management, however rather than

seeing it as a binary operation it should be considered fluid and dynamic focusing on the **hiding and revealing** of information as befitting the occasion.

The importance of hiding and revealing information has been highlighted throughout this thesis. This is especially the case when trying to support multiple personae. In Goffman's work he discusses how a performance can be 'discredited' when information that is damaging to it is revealed. As has been stated, in face-to-face interactions this can be managed more carefully—adapting where appropriate—however, when disconnected from one's own representation of self as is the case online an inappropriate presentation may be given. Therefore designers must consider the affects of both **synchronous and asynchronous** presentations of self and design to support both where appropriate.

Two other key considerations are the **longevity and reach** of a presentation. It has been shown in Chapter 2 the damaging effects of non-transient and globally available information, also in [72, 73] it can be seen how transient localised information enables individuals to change how others perceive them overtime. These two characteristics are extremely important in impression management. In Chapter 7 information used in presentations of self was transient however, this raises other challenges such as how long should a presentation be available? This is specific to the application and therefore must be carefully considered by designers when designing for impression management. While it is impossible to design systems that will always accurately represent an individual exactly as he/she would like—since we all ourselves occasionally behave in inappropriate ways—by carefully designing systems that control the duration of a presentation and how widespread it can become then, as discussed in 2.1.2 the damage of any misrepresentations can be minimised.

Finally **accountability** is another extremely important aspect of impression management. The author has shown how this can be supported by systems through the use of feedback. The thesis has also shown occasions where individuals were held accountable for their 'out-of-game' actions 'in-game' (see 7.1.4.4). While designers should design for accountability it should also be recognised that this is also done outside of the technology during our encounters with others. By explicitly supporting accountability in our technology users can take advantage of this to backup claims they make about themselves. Therefore accountability is extremely important in **maintaining and confirming** any presentations of self, made by an individual. This section will now illustrate the main

elements of impression management and outline which considerations are most appropriate to each particular stage in the framework.

5.4 Design Framework

This section of the thesis will illustrate the process of impression management, explaining each of the phases and highlighting where the challenges discussed above occur in the process. It is important to note here that this representation of impression management is a simplified view on what is an extremely complex activity. The aim of this is to provide designers with a coherent resource from which they can design to support impression management.

5.4.1 The elements involved in impression management

In impression management there are three important aspects that have emerged throughout the investigations conducted in this thesis. The first aspect is the affiliations that individuals make in order to present themselves appropriately to others. The second aspect is self-presentation, where a performance is constructed, presented and reflected upon by an individual. Finally, the audience and how they affect a particular presentation, how their feedback influences moment-by-moment presentation as well as subsequent presentations in the future. This section will outline each of these key elements discussing which chapters they relate to and the considerations that must be made at each point, before illustrating this process and discussing each of the challenges discussed previously, and finally outlining guidelines for designers wishing to support impression management within their systems.

5.4.1.1 Affiliations

The people, and artefacts one affiliates oneself with are extremely important when trying to present oneself to others, they form the basic resources though which impression management is done. In A.3 the important role that people and locations have on impression management has been shown. Also in Chapter 2 and A.4 the author has shown how artefacts both physical and digital can be used as positional goods. It is through these items and their interactions with them, that individuals build up a shared understanding of the world with others. In Chapter 2 these are also discussed as important features of context and how they can be used in the construction of one's own identity. Therefore affiliations in this sense are defined as follows,

Affiliation: these might be people, places, or artefacts that an individual uses to construct their presentation of self.

By supporting the capture and display of individual's affiliations they can maintain a particular presentation of self that they wish to construe to others. Often the affiliations one makes are with people, places or artefacts that one has a shared understanding of with others. This enables them to account for any claims they make and in turn enables those viewing any presentation to confirm whether it is genuine or not. However, this will be discussed further in 5.4.1.3.

5.4.1.2 Self-presentation

When presenting oneself to others individuals draw from the set of affiliations that they have, hiding those elements that are least appropriate and revealing the most appropriate elements as the situation requires. Throughout the course of the thesis self-presentation can be seen as a three stage process, involving the construction, presentation and reflection of any performance—although it is much more complex than this in practice. In general these phases follow on from one another, however each phase may provide feedback to the previous stage (see Figure 2). These stages draw from the experience of the outside world in developing a shared understanding with the audience about the things we affiliate ourselves with. In fact construction relies on our previous presentations that have been both successful and unsuccessful.

The Phases

These phases will now be defined and discussed in more detail discussing which parts of the thesis these have been drawn from and how they fit together.

Construction: the process in which an individual puts together a specific presentation to influence another's opinion of them.

In 0 the importance of capturing everyday activity and enabling users to create their own personalised record of their experiences was shown. While explicitly authored content—from the users—is integral to self-presentation supporting the capture of ongoing activity reduces the load when constructing any public presentation. In Chapter 6 new infrastructure was designed and implemented (and refined in Chapter 7) to support this implicit recording of everyday activity, including those one spends time with and places

one often goes. In 0 the use of software as positional goods and how individuals used it to gain kudos within their peer group was discussed and in A.3 players could be seen using the system itself as a way to show off to others. While in 0 logging of everyday activity facilitated the users in creating a post-visit blog of their visit they stated the desire to be able to tailor and craft that information after the event highlight significant events and take out items they felt were not relevant. This is supported by the Egor infrastructure in Chapter 7, where users can review and mark periods of activity to hide or reveal from particular members.

Presentation: the process of giving a specifically designed performance.

Throughout the thesis the difference between impressions 'given' and those 'given off' has been shown. In A.3 players could be seen working hard to give the impression that they were committed to the team. Often their play would lead to impressions 'given off' being construed by strangers as unusual behaviour, which made players feel self-conscious. In 0 players controlling the presentations they gave to show themselves as helpful and cooperative, they also took the opportunity to hide and reveal particular aspects of their play to bluff their opponents. In 0 users of the George Square system expressed their desire to be able to tailor and craft the information that was recorded about their visit so that 'boring' or 'un-interesting' parts of the visit could be cut out. This explicit tailoring is imperative in impression management but as the author has discussed this is not always possible when presentations are made when the presenter is absent. In Chapter 7 the system itself enabled the players to create presentations of self that could be tailored and presented even when made in the absence of the presenter.

Reflection: the process of scrutinising feedback obtained about one's own presentation of self with the aim of refining it in the future.

In 0 the importance of reflection in supporting system mastering and the development of a shared understanding has been shown. Also feedback provided during and after presentations provides individuals with extremely important material upon which to reflect and refine future presentations (see Figure 2). During the course of the thesis the author has shown three ways in which individuals have been able to reflect upon their experiences. These are self reflection—reflecting on one's own activities, comparison to others—directly comparing one's own actions against those of another, and seeing oneself

from the perspective of another—this can be done in many different ways but is readily supported by technology, through recorded data such as video.

Other Features

In keeping with Goffman's dramaturgical analogy each of these three processes can be seen to fit into his notion of back-stage, front-stage, and off-stage. Typically the construction of a given presentation is said to take place back-stage, the presentation itself is given on the front-stage, with feedback coming from those off-stage. However, as has been shown throughout this thesis this process is dynamic and fluid with aspects of the back-stage spilling out onto the front stage and with the feedback from those off-stage as well as those font-stage and back-stage influencing the current performance and future performances. This fluidity also highlights the need to recognise the importance of adaptation and how supporting it through awareness, system mastering, shared understanding and adaptive systems, should be done.

Adaptation: the process of changing one's presentation either in the moment or changing one's own behaviour to influence future performances based on audience feedback.

In 0 the Treasure system was designed using a seamful design approach. This revealed the underlying infrastructure upon which the technology was operating, giving players a deeper understanding of wireless networks. In doing so, players understanding of this extremely complex issue grew throughout their play and they were able to adapt their play as this happened. Using a seamful design approach increased users awareness of the technology they were using enabling them to explore new possibilities. This technique was advocated during the design of Castles and enabled players to construct their own personalised setup from which to built their armies and play the game. Awareness can often be seen as the first step in adaptation. As has been seen throughout the thesis, players adapt their behaviour around the system however, in 0 a new framework for explicitly supporting adaptation at a system level has been presented. This in turn supports the dynamic nature of self presentation enabling users to not only adapt their behaviour around the technology they use but also enabling them to adapt the technology itself.

5.4.1.3 Audience

Audience: the audience may be made up of an individual or group. These participants provide important feedback from which a presenter can tailor his/her presentation however, presentation may not always be focused at the audience—such as bystanders.

Audiences need not necessarily be witting participants in a performance. In A.3 the players actions were often misconstrued by the general public and this made the players feel self-conscious. However, when performances are designed and presented to a witting audience they can be designed for an individual or for a group. When designing a performance for a group this can be seen as designing for a generalised individual that takes account of the actual individuals that make up the group. This is how Egor constructs presentations that are aimed at groups. It is important to know the members that make up the group so that an appropriate presentation can be made for everyone. When presenting oneself asynchronously a login can be used to create an appropriate presentation to an individual, but it relies on other members of a group to make themselves known so that it may be tailored to the group [106]. This challenge is further discussed in 8.3.

In face-to-face communication, the audience can influence the performance given through the feedback they send to the presenter—often these take the form of facial or body gestures. The validity of any performance can be verified by the audience since they will also have knowledge of the items a presenter affiliates him/herself with. Provided this connection between those people, places and artefacts one affiliates their self with exists then, as has been stated in 5.4.1.1, a tension exists between the presenters desire to show oneself in the best light and to present oneself honestly. Again as the author has stated, if a presenter chooses to over-embellish the claims made about him/herself then this connection can result in embarrassment and in more serious occasions retribution (see Figure 8)

5.4.1.4 Summary

When using the framework designers must take into account the considerations outlined and apply them to the elements of the framework. This section will discuss the specific considerations that were made throughout the design and implementation of the various systems in this thesis. In Figure 8 the author has illustrated how these various elements of impression management fit together. The diagram shows the items that one can draw from to create affiliations used in one's self-presentation. When constructing a presentation of self these are drawn in from the outside world and used to construct a presentation given to

a particular audience. In turn this audience provides feedback which the presenter can reflect on and use to adapt the current presentation or reconstruct the presentation for future situations. At each stage it can be seen how it feeds into the next however, it need not follow the ridged structure discussed above. This is due to the fluid and complex nature of impression management. The author has tried to illustrate some of the key elements discussed in this chapter, such as accountability and shared understanding, introduced by the connection between the items one chooses to affiliate them with and the audience.

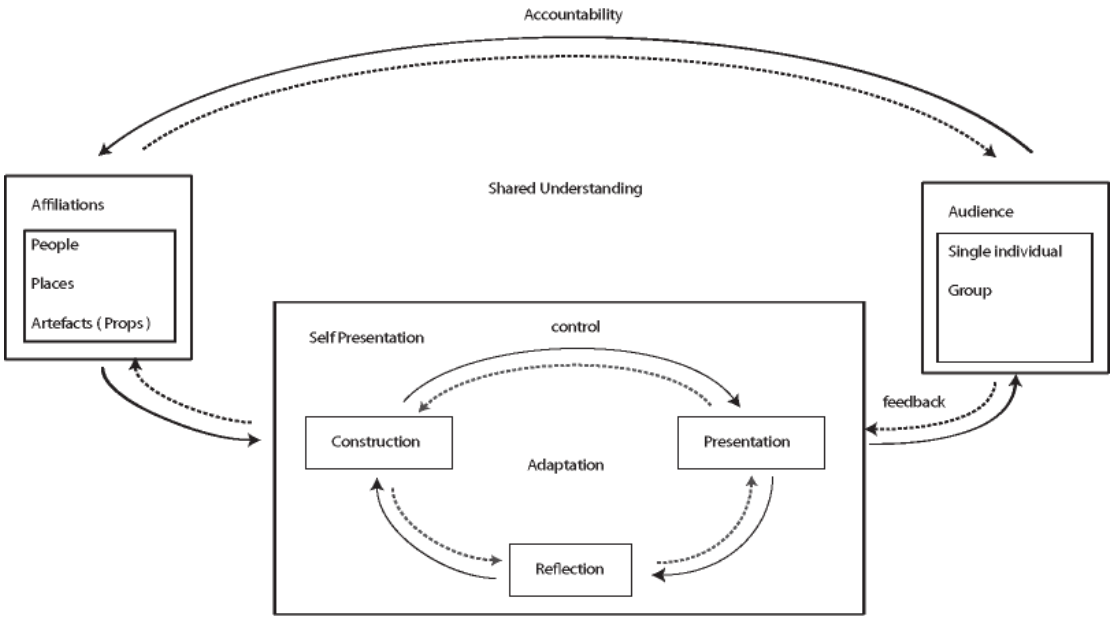

Figure 2: Design Framework for Impression Management.

5.4.2 Transitions

In the transition between aligning oneself with the items one wishes to affiliate oneself with and the initial construction of any presentation of self, designers must support the automatic capture of the use of those items. This reduces the workload on the presenter, giving him/her more resources from which to draw from without having to explicitly author the content. However, automatically capturing this information might be difficult as shown during the trial of CareNet [29]. While social networking sites such as Facebook [138] and MySpace enable users to incorporate their own explicitly generated content, they do not allow for implicitly captured information to be incorporated into the presentation. In games such as Pirates [10] and CYSMN [9] the physical activity of the players is used to drive their digital representations in the game, however, once the experience has finished these representations are no longer presented.

Instead, designers should consider enabling the capture of implicit activity to provide extra resources through which individuals might present themselves to others. This requirement can be seen from the work presented in A.3. In this case, the designers did not explicitly support the capture of 'in-game' activity such as where players played and with whom, however users worked hard to create the information that they used in their online presentations of self. Another example of this type of behaviour can be seen in Chapter 2 where the Drift Table [64] and the activity that surrounded its use was similarly captured and presented online. Several of the systems presented in this thesis have supported the capture of activity during an experience and enabled it to be presented to others in digital presentations such as George Square, Shakra, and Ego.

The transition between affiliation and construction in the framework is inherently linked to the transition between construction and presentation shown in Figure 2. What a user captures is explicitly linked to what they might use to create a presentation. While different types of information can be recorded in this way control must be given to the user when constructing a presentation so that appropriate choices over which captured information should be hidden or revealed when the presentation is made.

In the transition between the presentation and the audience there are a number of different things that must be considered. Feedback about the presentation itself is imperative if presenters are to adapt and change the ongoing presentation during the performance. In CarenNet [29] those being monitored expressed concern about not having the appropriate feedback stating who was able to view their information. One of the challenges the author has outlined is that presentations may be made in the absence of the presenter, i.e. asynchronously. This can hamper the presenter's ability to dynamically change a presentation to make it appropriate to the current situation. In [36] this tension was observed in a study of Facebook [36] users, and individuals could be seen 'cleansing' their profiles of all the information they felt might be inappropriate as their status changed from student to young professionals. However the author has advocated tailoring presentations at the point at which they are made, so that systems can support users in dynamically constructing presentations of self when they are not there to adapt them themselves. This may even involve displaying information in a particular way given the setting. For example, information that has health repercussions might be construed in a simple way to friends and family such as in [32] but in a more detailed way to doctors or medical professionals.

When a presentation is made to an audience, designers must also consider the availability of that presentation, particularly focusing on its reach and longevity, i.e. who should it be presented to, and how long might presented information be stored. Examples of problems arising when these issues are not considered are shown in [76] and [29]. Also in A.6 one individual's phone had some problems and showed him to be at the train station for a significantly longer period of time than normal and resulted in one of the other participants phoning him up to make sure everything was alright. Therefore, one way to try to prevent presentations that are no longer relevant and are misrepresentative is a system feature that ensures that they die out, such as a simple timer or a more complicated mechanism such as the epidemic algorithms as discussed in A.3. Other ubicomp systems such as Hocman have shown how opportunistic presentations of self can be supported by the use of epidemic algorithms.

Being able to support continuous feedback is required when one wants to support dynamic and timely adaptation of a presentation. Where possible, supporting a feedback loop between presentation and reflection is ideal, so that presentations can be adapted as they are made to the audience. This is the case in face-to-face interaction, but systems that make use of asynchronous presentations can hamper this feedback process since that feedback can only be obtained after the event. In these situations, designers should still support feedback through which future presentations might be adapted, e.g. logging audience use of the presentation, while also providing mechanisms that support ambiguity and therefore enable a presenter to explain away any misrepresentation (see A.6 and [44]).

The author has also outlined three different types of reflection that should be considered. Each of these methods may be employed either during the ongoing moment-by-moment feedback provided during a presentation or when reflecting on how a presentation was received after the event. In the transition between reflection and construction—or in this case the reconstruction—of a presentation, reflection becomes extremely important. It facilitates the presenter's decision-making process over whether to continue using the affiliations (or, in the case of Domino and Egor, data capture components) used in previous performances or distancing him/her self from them so as to be perceived differently.

The final transition illustrated in Figure 2, is the connection between the audience and the items presenters use to affiliate themselves with. This connection is implicit, in that

without the audience being aware of those things a presenter affiliates themselves with then no shared understanding can exist about what is meant when they are presented. This connection introduces accountability for the affiliations one claims, and can be used to confirm and maintain any presentation of self. Also they may be used to discredit a performance if the claims made are not supported by one's affiliations, as noticed by the audience. For example, in [72] the children made claims that one child said something about another. In the absence of the accused party, this report was not accountable, however, when the report was discussed with the supposed perpetrator the child who reported it was held to account for his/her actions if his/her report was untrue. Accountability for one's actions based on these outside connections can also be seen in the studies of PoliTeam [97] and of dating sites [48]. The author has also shown in A.3 and Chapter 7 how 'in-game' and 'out-of-game' interactions were made accountable through the use of the technology.

In Ego, the designer tried to take each of these phases into account and design explicitly to support each one. From this work, and the work of the framework, the author has drawn out some simple summarising guidelines that should be followed when trying to support impression management. These are presented in the following section.

5.4.3 Guidelines

The framework as discussed so far has gone into detail about the issues that the author has encountered during the research conducted for this thesis. The framework shows some of the challenges faced and considerations to be made when trying to support impression management in system design. While the framework provides a simplified view of impression management, it provides a reference that designers can work from. In order to assist the designer, this section presents five important guidelines that have been developed based on the framework. These guidelines are

- Systems should enable users to capture the information they wish to use in self-presentation
- Systems should support the tailoring of this captured information
- The creation of an appropriate presentation of self, given the current context, should be facilitated.
- Systems should support reflection through feedback based on the audience's reactions to the presentation.

- Presentations should not be indefinitely and freely available unmodified to the audience.

It is hoped that this simple set of guidelines will facilitate those designing for impression management. The thesis will now conclude by summarising the thesis and the overall contributions made, finally the author will outline future work.

Chapter 6 Infrastructure for supporting impression management

6.1 Introduction

This chapter outlines the development of an infrastructure for creating tailored presentations of self, called Egor. The Egor framework adheres to the guidelines set out in Chapter 5. The motivation behind the design and implementation of Egor was to provide individuals with an infrastructure that supports dynamically tailored digital presentations of self. The aim is to provided infrastructure that can tailor information based on the audience and the context in which they are viewing a presentation when the presenter is not present. Unlike social networking sites where presentations are static and are not tailored to those viewing the information, Egor was designed to reduce the occurrences of misrepresentation.

Egor was also designed to support the integration of recorded data logged during everyday interaction. Therefore the need to explicitly author content can be reduced; also this recorded information is used to drive the tailoring mechanism for presentations. Tracking everyday activity and providing this as a resource to users in presenting themselves required other infrastructure, including suitable hardware and software. The remainder of the chapter outlines the requirements for hardware required for this type of self-presentation and the software infrastructure that evolved as a result of the research conducted in this thesis resulting in the Egor framework.

6.2 Selecting a device

To track the activity of users in order to provide it as a resource for self-presentation it was decided that individuals should not have more than one device otherwise it would become unmanageable. Several of the applications in Appendix A required information and activity to be tracked however, these often required multiple devices that were often clunky and problematic for users. Instead devices that can provide the ability to track activity without additional—external—hardware are imperative to maintaining manageability. Any device also has to have reasonable battery life since such systems are required to run continuously in the background. To provide self-presentations information must also be shared between those in close proximity as well as providing the opportunity

to share information with those at a distance. Therefore the four requirements for a device were,

1) Small form factor
2) Tracking
3) Long battery life
4) Sharing of activity level

Through the authors early experience two types of device were considered for the infrastructure created, PDAs, and mobile phones. PDAs did not have the required battery life, and were much larger and more bulky than mobile phones. Using mobile phones also meant that users could insert their own SIM cards into the devices—using them as their main phone—and would only need to carry one device around, rather than their own phone and a PDA. With the decision made to use mobile phones, the choice of device had to be made so that the previous four requirements could be met.

The choice of devices readily available at the time consisted of Nokia and Windows Mobile Smartphones. Nokia Smartphones run the Symbian operating system. While the largest number of devices on the market supports Symbian[7], each device has a different user interface implementation, leading to problems of incompatibility between devices. This restricts the widespread use of applications over different devices, even if they use Symbian. Symbian phones can run both native and Java applications, however access to the phone's built–in functionality can be quite restricted. For example, any time an application requires the use of the GPRS connection, the operating system prompts the user with a dialog, and the connection must be accepted before the application can continue. Another disadvantage of using Symbian–based phones would have been that all of the code libraries and experience gained through the development of Treasure (see A.2), Feeding Yoshi (see A.3) and Castles (see A.4) could not have been used. Therefore it seemed appropriate to move to Windows Mobile.

There are two types of Windows Mobile device: Smartphone and Pocket PC. The simplest and most evident difference between the Windows platforms is that Pocket PC devices have a touch screen, where as Smartphones do not. While a touch screen can provide an

[7] http://en.wikipedia.org/wiki/Smartphone#Operating_systems

easier mechanism for interaction, most of the devices with this capability, like the PDAs used before, are much more bulky. Therefore a trade–off had to be made and this was made in favour of size, since interaction with the application would be limited—sharing and tracking were automatic so switching between views was all that was required.

For communication, both Smartphone and Pocket PC Windows mobiles can use either GSM (Global System for Mobile Communications) or CDMA (Code Division Multiple Access) with either GPRS (General Packet Radio Service) or 3G data connections for sharing information. GSM is the mobile phone standard in Europe and CDMA is predominantly used in USA, therefore GSM communications had to be used. The data connection that could be used for sharing was constrained, due to the lack of 3G coverage of the area where the trial was being conducted (at the time of the trial). Therefore, GPRS was the technology used to share data between users.

Both Smartphone and Pocket PC devices use the same operating system, which was based on Windows CE 5, and therefore much of the author's previous experience with Windows CE could be used. However, the two platforms have different user interfaces, with one optimised for key input and the other for touch screen input. Windows Mobiles of the time typically had a 200Mhz-675Mhz CPU, 64Mb RAM, 64Mb ROM, WiFi and Bluetooth, and they offered memory expansion via SD memory cards up to a size of 8GB.

With the platform chosen for Egor the following sections will discuss two important elements fro supporting impression management. These are, design for disconnection and supporting adaptation. It is important to design for disconnection so that dynamic presentations of information can be made between two collocated individuals in the absence of any centralised infrastructure. By providing a suitable infrastructure for adaption facilitates users appropriation at a system level, increasing the level of customisation available.

6.3 Design for disconnection

Designing a system that would work reliably across the seams of the wireless network proved challenging and it was a problem encountered during the use of George Square (see Section A.1.4.1.1) and explicitly designed for in Treasure. An appropriate networking system that could handle disconnection and reconnection, and would also work in areas of patchy signal strength was needed.

6.3.1 Wireless Driver: Stage 1

The standard Pocket PC (PPC) and Windows Mobile (WM), wireless driver proved problematic in this case, for a number of different reasons. Firstly, the built in driver continually requests the operating system to ask the user about any network connection decisions that need to be made. For example, users are continually being notified of new networks through a GUI pop-up stating "New Network Found" that they must choose whether to connect to or not. This is not only annoying for users but also requires users to have knowledge of various connection issues such as IP addresses and wireless security. Furthermore, as there are no mechanisms for automatically connecting to networks, there can be substantial periods when the device simply remains disconnected from all networks whilst it waits on user input.

To resolve these problems and support the movement of users in and out of areas of network coverage a custom wireless driver had to be created that enabled users to 'lock on' to a particular network SSID and only ever allow the mobile client to reconnect to that specific SSID even if their were others available. This initial version of the driver was used in Treasure. During this trial static IP addresses were used, therefore removing any time needed for requesting an IP address. This allowed data connections to be established very quickly when clients returned to the network, and increased the chance of a successful connection in areas of weak coverage.

The driver created is mainly implemented in C# but certain parts of code which interface with the NDIS[8] APIs on the device are written in C++. The driver deactivates the standard PPC or WM driver and also, optionally, disables the network notification bubbles that can prove distracting to the user. Once the default driver is disabled, the new driver enables, the wireless card to be turned on and off, scanning of 802.11 networks to be conducted, the connection mode to other devices to be switched (infrastructure or ad hoc), networks to be joined and IP addresses to be automatically configured.

In short, the driver through a simple set of API methods makes full control of the wireless card available. This bypassing of the default driver to allow full control of wireless functionality is the first part of the wireless driver. The second part of the development of

[8] http://www.ndis.com/

the wireless driver saw three areas of modification, network discovery and connection, peer discovery and finally data transfer

6.3.2 Wireless Driver: Stage 2

In Section 2.3.4.1 MANETs were discussed in detail and several systems that make use of this type of architecture were introduced, Hocman being one of these systems. While the MANET configuration worked well in the Hocman system there were limitations that were not discussed in the published work but are known from conversations and experiments with the authors. These limitations impacted on the dynamicity of ad hoc encounters. The devices had to be preconfigured with a set SSID and IP address and they must be within range of one another when they were first set to ad hoc mode, or they would not be able to meet. This was common of the devices at that time and was most likely due to constraints in the wireless drivers. This constraint was caused by the fact that setting a device to ad hoc mode actually created a hidden BSSID that was used as a fake infrastructure node that two peers in range could both address. As this BSSID was created randomly, if the two devices were not in range of one another when set in ad hoc mode they would be forced to generate separate IDs. Therefore, the two devices would not be able to communicate, as the IDs would be different when they came into range again, and the protocol rejects any messages not received from the BSSID that matches that currently stored. The 802.11 specifications defines that if ad hoc devices with the same SSID move in range of each other then all devices should associate with the same simulated BSSID. However, in practice, depending on the WiFi device and driver used, this is not always the case.

In order to maximise opportunities for interaction during chance encounters, peers continually attempt to meet on a certain network, and will consistently switch to one appropriate ad hoc network when no other network is available. Mobile systems using this custom wireless driver actively seek out infrastructure mode networks and connect to them whenever possible. When no networks are available, they switch to their own ad hoc network. These features allow peers to contact each other even when no 802.11 infrastructure mode networks are present, while still permitting users to use infrastructure access points to connect to the Internet as they normally would. In our trials the custom wireless driver code was extremely quick in carrying out the required switching between networks and network modes. In an experiment carried typical times involved with 802.11 connections were:

- Switching between infrastructure mode and ad hoc mode: 1ms
- Associating with an infrastructure access point: 3s
- Time to acquire an IP address via DHCP for infrastructure: 5s
- Time to set IP address for ad hoc: 3s
- Discovering a peer after joining a network: 1s

The next two sections discuss two new features added to the wireless driver itself, peer discovery and data transfer. These features where imperative in supporting opportunistic interaction between players, and also enabled components to be transferred in A.3

6.3.3 Self Discovering Spaces

Once the wireless driver has successfully connected to a network, be it fixed or wireless, the Self Discovering Spaces (SDS) component repeatedly sends out packets advertising a service along with an IP address and port number on which it can accept connections from other mobile clients. This allows any other mobile systems on the same network to discover, connect to, and request and receive information quickly from other peers. SDS was very much a lightweight mechanism for peer discovery unlike EQUIP used in George Square.

	Bluetooth		Ad hoc 802.11		Infrastructure 802.11	
Range (m)	Avg time (ms)	% succ	Avg time (ms)	% succ	Ave time (ms)	% succ
1	4256.7	80	9.9	100	52.2	100
5	4247.3	100	9.0	100	45.1	100
10	15081.6	55	9.1	100	51.2	100
20	N/A	0	10.1	100	66.8	100
50	N/A	0	11.2	100	167.9	100
100	N/A	0	14.85	100	N/A	0

Table 1: Peer discovery times and success rates.

SDS clients use a UDP broadcast to advertise the service. Simultaneously, they listen for broadcasts from others' PDAs on the same network. This is similar to the manner in which the ZeroConf service discovery operates, but is achieved in a more lightweight fashion, which is more suitable for a device that may frequently be connecting to different ad hoc WiFi networks. When another client is detected and the user indicates their desire to initiate an information exchange, SDS stops scanning and sends a message to the other PDA requesting it to cease scanning too. This is vital as continual scanning is a relatively

heavyweight network task for 802.11 on PDAs and has been found to interrupt or slow the network traffic being transmitted between the devices. A series of tests of SDF were carried out. When testing the Bluetooth and the ad hoc discovery rates the devices were placed the relevant distance apart from one another. For the infrastructure test this distance was measured from the device to the access point and not between the devices, with both devices opposite one another with no obstructions between them and the access point.

At each distance, peer discovery was attempted 20 times, with the time and success rate noted. If the attempt to discover a peer was not successful after 60 seconds it was noted as unsuccessful. Table 1 shows the results of these tests. It is clear from the results that both ad hoc and infrastructure 802.11 are much better than Bluetooth when it comes to peer discovery. Even within the 10-metre range that the Bluetooth protocol specifies that Class 2 devices should operate, there was a clear sensitivity to range. It is commonly known that Bluetooth devices are not reliable when they are either too close or too far, and this is borne out in the results of the trial which show that discovery was only 80% reliable at 1 metre distance and 55% reliable at 10 metres. Furthermore, the time for peers to discover one another was substantially higher between 5 and 10 metres, more than tripling from just over 4 seconds to over 15.

802.11, however, provides extremely reliable peer discovery from 1 to 100 metres. In ad hoc mode, any range within 100 metres seems to affect discovery rates very little. However, in infrastructure mode the range seems to have a stronger affect and it is clear at 50 metres there is a marked increase in the time taken for discovery to occur and at 100 metres there are no successful discoveries whatsoever. This difference from ad hoc mode may be due to the aerial on the access point itself being less powerful, or more obscured, than on the devices. An Apple AirPort was used as the infrastructure access point and the casing that surrounds the internal aerial may have interfered with the signal. These tests proved the reliability of SDS over 802.11 and showed it to be the best choice for supporting peer discovery. One final challenge had to be resolved, reliable data transfer between devices.

6.3.4 Asynchronous Data Transfer between Peers

One of the major problems with ad hoc communications is that they can easily ‘break’ or become disconnected. An object such as a person or a car passing between two clients can be enough to disrupt communications. Also in mobile environements, clients may move in

and out of range of one another while trying to exchange data. It is a requirement that devices can exchange information in a reliable and robust way in this type of environment, this is why data must be transferred asynchronously.

Asynchronous data transfer enabled the players to continue playing whilst data was exchanged in the background. It also meant that if a connection was broken, and the transfer of data was to fail, it would do so in an elegant fashion enabling the users to continue playing or try again. Also using a mutli-threaded asynchronous technique for communication between devices was a much more scalable approach that the approach used in Treasure. This enabled multiple devices to make requests to the same device simultaneously.

Enabling robust ad hoc peer-to-peer data transfer provides the opportunity for system designers to use epidemic dissemination techniques within their systems providing flexibility and mobility that is often restricted when using centralised architectures. For a system such as Feeding Yoshi data dissemination between pairs is trivial as messages are short-term and are only meant for the two devices. However, for sharing content, especially user created content it may have to go through several 'hops' before it reaches its target destination, a much more complex approach that might include specific routing algorithms would have to be created. This is out with the scope of the thesis.

The theory of epidemic algorithms originates form the study of illness in the field of epidemiology. Epidemiology studies the spread of disease in a population, when a disease spreads quickly and infects many individuals it is called an epidemic. There are two elements that are necessary for infectious disease to spread, a specified population and an exposure to the infectious material. This highlights the problems that researchers have had in studying epidemic algorithms in mobile environments because it is often difficult to recruit sufficient numbers to get the correct density of users to observe this phenomenon. Goffman & Newill describe the process of epidemic dissemination [70].

> *"In general the 'epidemic process can be characterised as one of transition from one state (susceptible) to another (infective) where the transition is caused by exposure to some phenomenon (infectious material)."*

It was in this paper that Goffman and Newill introduced the idea of 'intellectual epidemics' based on this idea that transmission of ideas or information is an epidemic process.. One of

the advantages of epidemic techniques is that they are highly scalable and are not dependent on any one particular node being continually available. Indeed, Vogels et al. [130] state that:

> *"These protocols allow systems to be built in pure peer-to-peer manner, removing the need for centralized servers…"*

As mobile communities are never static, and have nodes that are highly transient, epidemic algorithms that are not dependent on any single node are particularly useful in mobile environments. Despite the fact that the work of Vogels et al. [130] does not concentrate on using epidemic algorithms in mobile environments, they do highlight the properties that help make epidemic algorithms effective in mobile environments:

> *"An epidemic-style protocol has a number of important properties: the protocol imposes constant loads on participants, is extremely simple to implement and rather inexpensive to run."*

The fact that epidemic algorithms are relatively simple and inexpensive to implement and run aids their use on mobile platforms, which typically have less processing and storage capabilities than their desktop counterparts.

Whilst there is a substantial amount of other literature focusing on epidemic models and their simulations [89, 100], Demers et al. [33] take a slightly more practical approach and describe how epidemic algorithms may be applied to use with databases. The epidemic techniques Demers et al. detail, in particular rumour mongering, can be applied within a peer-to-peer community to spread data throughout the community. Rumour mongering, as a technique is also very important to impression management. As has been stated in Section 2.1.2 Grudin notes the problems when it is logged, especially on the Internet. However, this technique stops spreading information when it becomes out of date or is no longer of interest to the peers in the group.

6.4 Domino: An architecture for adaptation

As has been seen in Section 2.1 appropriation and adaptation are extremely important to impression management. The focus here is on the system adapting its structure to better fit with the dynamically evolving needs of the user. Functionality is added, removed or

replaced when necessary, and can either be automatic or user–driven, that is, the mechanisms here can be used in either adaptive or adaptable systems, to use the distinction of Findlater & McGrenere [58].

Domino's inspiration is drawn from MacKay's study described in [96], which demonstrated people's practices of sharing software customisations—in this case Unix customization files. There are a number of factors that lead people to want to adapt not only their personal practices but also the structure of the systems they use. These include improved efficiency and personal customisation. For example several applications, e.g. Firefox, provide users with plug-ins that can be used to improve performance, however, in practice this can be problematic. Individuals don't often have the time to trawl the Internet to find the best components and even when they are presented to users they may be reluctant to change. On such occasions, people often look to colleagues or friends for inspiration. Domino is designed to augment this behaviour by automating the process of sharing recommendations between friends and colleagues. Improvements could even traverse the social group boundaries in organisations, as identified by MacKay.

The following scenario represents what Domino aims to achieve. James is walking down the street and has his mobile device switched on in his pocket. He enjoys dining out and going to the theatre, he frequently travels into the city centre by bus to take part in these activities. On his device is a Domino–powered application consisting of a restaurant guide, a list of upcoming theatre shows and a map of bus routes. As James walks down the street, his device discovers another Domino system being carried by someone else nearby. The two systems connect and transfer data between on another. Later in the evening, as he begins to use his device, he notices that he has a recommendation for a module that displays bus time schedules. This module is clearly useful to him and complements his map of bus routes perfectly, and so he installs it and soon makes use of it to plan when to make his journey home. In summary, while James simply went about his day as normal, his device discovered another Domino system, shared data with it, generated module recommendations, loaded new modules, and presented them for James' approval. Most of this adaptation was done without requiring James' explicit interaction, as he only had to handle the choice of which recommendations, if any, to accept.

Domino's design was influenced by mobile peer-to-peer systems such as Feeding Yoshi and other social proximity applications [19, 20, 108]. Domino has three aspects to its

communication system: nearby user discovery, exchange of contextual histories including software use, and exchange of software functionality. The communication and transfer draws upon the work presented in Section 2.3.4. The recommendations are generated by Recer [27] using the historical model of context discussed in Section A.1.

6.4.1 Discovery and Data Transfer

The communication method discussed previously is the basis of the communication method used in Domino. It utilised the same wireless driver to connect to infrastructure networks or create ad hoc networks to discover peers, and transfer both history logs and Domino modules. When a Domino peer is discovered, historical logs of module use are exchanged between peers and stored in the local databases used to generate recommendations. Domino devices can therefore carry the logs of multiple users, to be further shared with other peers when they are discovered along with the owner's log. The Domino communication system is responsible for the exchange of software modules. The transfer of history data and modules when Domino clients meet leads to controlled diffusion that is inspired by the epidemic algorithms of Demers et al. [33] and others as discussed in 2.3.4, and experimented with in the Far Cry system [128]. Popular modules are quickly spread throughout the community, whereas modules that fulfil more specific needs spread more slowly and yet are likely to eventually locate a receptive audience because of the history–based context matching and the use of 'wanted lists' to find required modules.

6.4.2 Recommendation

Domino's recommendation system design is also influenced by the contextual history–based technique in and its successful demonstration in George Square. An advantage of using a historical model such as that used by Recer is that it is generic in its storage format and thus many types of contextual information can be stored. Therefore, if Domino is required to log other types of contextual information, for example GPS location or the number of peers in range, then this is also possible. The recommendation part of the system is required to make requests to peers for history logs, via the communication system. The main functionality of the recommendation system is to generate recommendations for software modules. When a recommendation request is made a ranked list of software modules is produced highlighting those that might be of most interest. Finally, the recommender system is responsible for capturing and logging the use of

software modules, to create the basic information shared with others and used to generate the recommendations.

Once a module has been recommended, and the communication system has retrieved the module, control then passes to the adaptation system. A module's invocation may either be automatic or require the permission of the user. Then Domino will attempt to dynamically load it into the running configuration. The adaptation system uses reflection to obtain the module's root class, which implements a simple interface, the Domino Module Interface (DMI). As well as basic start, stop and pause methods, the DMI contains methods for querying and modifying the module's dependencies and dependants, and a method to expose what types of modules it can support. During development of a module, the programmer must specify the minimal set of modules it is dependent on for successful execution. Since dependencies are defined as type name strings, modules can support multiple dependencies according to the class or interface types its DMI-implementing class inherits from or implements. An example of a dependency is a map layer that is dependent on a map viewer to display it. If dependencies cannot be fulfilled then the module is not started, and if there are any named dependencies these are added to a 'wanted list' in the communication system. If the dependencies are fulfilled then, subject to any user approval, the module is started. The final step is that a call is made into the recommendation system to log the use of the module to the database.

To summarise, Domino was designed to be as generic as possible, without sacrificing ease of implementation of modules by developers. Often adaptive architectures can have inefficient and cumbersome communication protocols between modules. For example in SpeakEasy [46], the modules communicated using text messages formulated using a specific pre-defined protocol. To overcome this weakness, Domino has been designed to support normal function calls across module boundaries allowing modules to be developed as if they were part of a normal static application.

Due to the generic nature of the system model, when a module is received there is no predetermined place for it in the system. In the simplest case, the new module can query the Domino system's running modules to find others that satisfy its dependencies. This is achieved by analysing the module and the interfaces it implements, however, a problem arises when multiple satisfactory modules are found. In this case the recommender is used again to decide where is best to fit the module.

The premise of adaptation in Domino is extremely important when trying to enable users to appropriate and adapt their systems as well as their system use, so as to best reflect themselves to others. The analysis of Domino, through Castles, shows how people discussed the technology and utilised it to best present themselves to others for various reasons. These included showing off, bluffing and helping out others, as discussed below.

6.5 Egor: An architecture for tailored self-presentation

This section presents an architectural design directed towards dynamic presentation of self in online and mobile systems, so as to fit with the user's constantly changing context and audience. The idea, design, and implementation of Egor were entirely the work of the author. Egor's design was inspired by background research of other ubiquitous computing systems, social networking systems and sociology literature, as well as experience gained in development and studies of the systems presented earlier in this thesis.

Inspiration is drawn from Goffman's view of self-presentation in [68], which describes self-presentation through the use of a dramaturgical analogy, highlighting several key areas, such as front stage and backstage. He also discusses the impact of the audience and how performances are tailored to the particular audience of a given time and place (see 2.3). Egor supports two types of presentation, those that are dynamically tailored to the specific performer's current context and those that show what the performer has in common with the audience. These presentations are automatically tailored, however, Egor's inbuilt access control allows for individuals to mark elements or sections of their histories to be hidden and the set of individuals they are to be hidden from.

Egor also provides mechanisms for displaying what people have in common with one another. As has been discussed in A.1 Simmel stresses the importance of common norms shared by both parties in conversational exchange. One of the forms of conversational interaction explicitly discussed by Simmel is the discovery of common convictions and its importance in socialisation for establishing relations between individuals. However, while common convictions can be observed by an external observer we have to be careful when trying to assume that they exist since there is always the possibility that someone will act in a way that disproves the commonality. In Egor no assumption is made about common convictions instead the system merely presents information that the players have in

common, leaving the decision of whether this shows common convictions between players or not to them and their negotiation with one another.

In A.1 the use of the George Square blog highlighted the importance of allowing users to capture their own activity for review at a later date. The system acted like a scrapbook of their tour and enabled them to share their visits with others. However, while the players liked being able to view their visits and share them with others they expressed the desire to be able to tailor this information. The reason for this was twofold, firstly the players wished to edit their visit to cut out parts that they did not think would be interesting to others and secondly the players wanted this to be able to hide certain things that they had done so that others could not see it. This desire for tailoring captured data was significant in the design of Egor. In the second part of 0 seamful design is introduced and discussed. Using this method of design enables users to gain a greater understanding of the systems they are using and appropriate them to best fit their needs. It is this support for appropriation that is needed to enable users to present themselves to others in a way that best meets their needs.

In A.3 the importance of unpredicted interaction is shown. Being able to weave systems into everyday life provided users with a resource through which social interaction could occur. It was also seen how players work together both with other players and those outside the game to present a façade suitable to those within the team [68]. In order to show one's self as a 'hard working' player, individuals asked friends and family to help. This appeased their team mates, preventing further retribution for not playing. Egor explicitly enables different types of data to be logged and used in its presentations. Since people and location were seen to be of primary importance in presenting oneself in A.3 and also highlighted by Dey & Abowed [35] as important aspects of context both these should be supported by any application using Egor.

In 6.4 system adaptation was considered and a design framework called Domino was presented. Enabling users to choose their own system configurations provides a freedom to present themselves at a software component level. In [48], Elision et al. discuss how individuals carefully considered how others might interpret their profiles, and carefully assessed the signals each small action or comment received about their profiles. Elision et al. also note how the restricted categorisations used in social networking sites, in particular dating sights, meant that people were forced into 'lying' or misrepresenting themselves.

> *"For example, participants tended to misrepresent their age for fear of being "filtered out". It was not unusual for users who were one or two years older than a natural break point (i.e., 35 or 50 to adjust their age so that they would still show up in search results."*

It is for this reason a more dynamic method of categorisation (or data capture) is advocated by Elision et al., and this reinforced the design decision that Egor should facilitate different types of data. For example, Domino-using individuals are free to choose which categories or components (logging components) that they wish to use to define themselves. In Domino while this flexibility enables people to define how they present themselves, common understandings of what different categorisations or components mean is supported through the sharing of components and recommendations. This is important in impression management as it helps individuals form reliable expectations about others. This dynamism is required when supporting self-presentation of substantial richness, and this is why Egor builds upon the path model [27] to support a historical view of context s[22] that supports many different data types.

In A.6, reflection and repartee are discussed. Reflection is one of the most important aspects of impression management, in that feedback given from those who are privy to any presentation influences future presentations (see 2.3). Egor aims to give this feedback even when presenting oneself asynchronously, as is often the case in online presentations. Also while awareness of oneself can help when reflecting on one's own actions, shared awareness of others can support repartee. This awareness is enhanced through the use of Egor, which can provide information about what others are doing and what individuals have in common. This section will now present two scenarios that Egor and applications built using Egor are designed to support.

6.5.1 Scenarios

Example scenario 1, this scenario is intended to demonstrate a social proximity application, and focuses on interaction when users are in close proximity:

James goes out during the day to buy a new shirt, as he is going out with his friend John later that night. He bumps into his friend Bob, who he regularly plays football with, and stops to chat. Later that night, James meets up with his friend John in the pub for a few

drinks. Both James and John know Bob but are unaware of each other's friendship with him. James knows him from playing football while John works with him. Like most, James always carries his phone around with him, as does John, and both phones have an Egor-based application. When they meet up with one another, James' and John's systems detect each another, and connect and transfer data. James and John get out their phones to discuss their day and share some video clips with one another. The application shows what they have in common with one another, most of which they are aware of, however they notice that they both know Bob. They consequently start a conversation about how they each know Bob.

Example scenario 2, this scenario is intended to show tailoring of presentation based on one's context. It is again intended to show a social proximity application, but focuses presenting oneself at a distance:

As James goes about his day, his activity is logged by his Egor-based application. He has decided that this application will log his location, via a module that enables him to mark locations using WiFi fingerprints, and to log who he is with via a module that records nearby Bluetooth devices. This information is uploaded using his phone's GPRS data connection to an Egor-enabled social networking site. His friend Bob decides to log onto the site later that evening and he looks up James, he sees what they have in common based on the data logged by their mobile Egor applications and also since he often spends time with James he sees a significant amount of information that currently reflects what James is doing that might be of interest to Bob. He sees that James is in a nearby pub and goes down to join him. While James takes privacy seriously he does not restrict access to his page. Instead he allows Egor to tailor the presentation to the given audience, accepting that there may be occasional miss representations but hoping that the correct presentations will be made in the majority of cases. Later that evening one of Bob's friends John goes online and browses through a couple of Bob's friends including James. Since John does not regularly see James he does not see much about his current activity however, he is shown what they have in common. This shows they have lots in common, this includes going regularly to the same football stadium, which he infers to mean that they support the same club. This prompts him to send a comment to James introducing himself.

6.5.2 Implementation

Egor was written in C#, making use of Microsoft's .Net framework. The .NET framework is available in a slimmed down version designed for mobile devices named the Compact Framework. Microsoft .NET is similar to Java in that it is a high level object oriented platform that runs in a virtual machine—CLR (Common Language Runtime). Its applications can be written in C#, J# (similar to Java), Visual Basic and C++ Since the author has been involved in developing a number of .NET libraries throughout the course of this work, it made sense to use this platform so that any demonstration of Egor would be able to utilise these libraries. Most of the core .NET functionality is available in the Compact Framework and it allows use of the majority of windows mobile UI components, access to databases, networking and simplified web services. A very powerful feature of the Compact Framework is its ability to call native libraries directly without any bridging code; this is made possible by the Marshal classes in the .NET framework that are responsible for converting data from the managed CLR memory to unmanaged, and that handle data type conversion automatically. This allows the Compact Framework software to utilise native device features such as WiFi and Bluetooth scanning. The Compact Framework supports simplified access to SQL CE, a database for Windows Mobile devices, and powerful data binding classes for linking data structures and user interface components to data in a database.

6.5.3 Synchronisation

The design of Egor was inspired by the use of mobile peer-to-peer systems as a means to present oneself to others. While it is important to enable users to make use of unpredictable interaction—from the perspective of the designers—and to provide tailored information during these meetings, Egor was also aimed at using ubicomp systems to link everyday activity to online presentations made on social networking sites. It was these two requirements that made it important that Egor had two methods of communicating information to be used in self-presentation. Therefore Egor made use of the peer-to-peer ad hoc data transfer mechanism discussed in A.3, as well as a synchronisation mechanism that enabled data to be transferred to a centralised data store A.6.

Each mobile Egor client uses a local database to store logged activity for exchange with others or synchronisation with a central store. Egor uses compressed XML datasets when transferring information both to clients, via ad hoc peer-to-peer connections—similar to that used in Feeding Yoshi and Castles—and to a central store—similar to that used in

Shakra and Connecto. Egor clients can request tailored information either from another mobile Egor client or from the Egor-enabled central store, so that tailored presentations can be made both when clients are in close proximity to one another and when they are apart. Syncing with the centralised Egor data store can be done over a variety of connections including WiFi and GPRS. In previous systems such as Connecto and Shakra, a similar technique was used to share information via a centralised server with data synchronisation occurring every 7-15 minutes. This timeframe can be set by applications using the Egor framework, and is often reliant on the length of the window of time used to model an individual's 'current' context. For example, the shorter the window the more often synchronisation has to be done.

6.5.4 Tailoring

Egor's system design is inspired by the contextual history-based technique in Chapter 2 and which was successfully demonstrated in the *George Square* and *Castles* recommender systems. An advantage of using this technique is that it is generic in its storage format and thus many types of contextual information can be stored. Thus if Egor is required to log other types of contextual information, for example GPS location or the number of peers in range, then it will be possible. Providing a framework that can make use of many different data types in this way is extremely important for supporting impression management, as it provides users with the ability to choose their own system configurations, as in Domino/Castles, enabling users to choose exactly what is logged and used for presentation. Also, the tailored presentations produced by Egor can be used to combat the static presentations highlighted in [48, 76]. In the future (see 8.3), it is hoped that by combining Egor with Domino users will have even more flexibility over what information they can choose to log about themselves for use in subsequent presentations. Indeed this would provide users with the opportunity to choose whichever categories or components they can use to best represent themselves as expressed in [36].

Privacy is supported in several different ways in Egor. The premise of Egor is that individuals can choose what they wish to have logged from the set of features offered by the system. There is also an explicit access control mechanism that enables users to explicitly mark areas of the historical log as hidden from particular individuals or groups. It is hoped that explicit access control should only be required occasionally, for information that individuals wish to share with only a select few. Instead it is hoped that the automatic tailoring of information would be enough to create presentations that will not

cause embarrassment. Egor also supports self-reflection in that it can be used to allow a player to view his or her own information from the perspective of another individual, for example person A can see what person B would be presented with about them. This feedback can then be used to later decide whether to change one's own behaviour or restrict which information others can view, aiding in deciding what should be private and from whom.

6.6 Summary

To summarise the main functionality of Egor is to generate profiles tailored to the presenter's current context and the audience viewing them. These are achieved by selecting the most recent log entries representing the current context, for example, from the last 10 minutes to a day depending on the application, and using that as the context from which to profile the profile.

The Egor framework is made up from the following parts:

- Data capture—with Egor's historically–based model of context, several different types of information are supported by the infrastructure. The data types that can be stored must have a duration associated with them so that they can be fairly compared against one another as well as against other items of the same type.
- Communication—the communication supported is two fold, peer-to-peer ad hoc and centralised, so that tailored presentations can be made on the fly, opportunistically, as well as with those distributed over time and space.
- Tailored presentation—this can be used to show items of interest to an individual in his/her current context, i.e. things that express what they are interested in at each particular moment, as well as items of common interest between the individual presenting him/herself and the audience viewing the information. Egor tailors presentations based on groups therefore they can be tailored to a set of recipients or just one. However, this requires additional work by designers to track which individuals are currently together viewing the same presentation.
- Access control—access control is built into Egor, enabling players to explicitly mark sections as hidden, whilst specifying whom they are hidden from. The notion of reflection is very important when managing this information. It is therefore possible using Egor to review what others might see about you 'through their eyes'.

Egor can be set to show what you have in common with each other, and to show the items of interest to you in another's history based on your current activity. To further support privacy, it can be set that the amount of this personal information about your current interests is based on how much you have in common with the recipient, as well as time spent with one another. A key design goal of Egor was to help users develop trust in the system. This was facilitated with explicit access control that could be used until they were happy that the automatic tailoring would be sufficient to prevent any major misrepresentations. Also the ability to reflect on what others see enables users to make an informed decision as to whether the system is working well for them or not.

Chapter 7 Ego: Supporting Tailored Presentation of Self

This work builds upon many of the previous experiences discussed in the thesis. The aim was to enable players to use everyday technology to record information from their everyday lives that can be used to tailor their online presentations of self. In this chapter, *Egor*, an architecture for supporting this tailored presentation, will be presented, and its' use in a mobile multiplayer game called *Ego* will be described. Ego uses the Egor framework for tailoring each individual's presentation to the specific audience at a given time, using historical information captured from his/her everyday activity. The design, implementation and evaluation of both Egor and Ego were done solely by the author.

As has been shown in many of the systems presented in this thesis, weaving system use into everyday life is extremely important and it is one of the primary foci of Egor and Ego. By making use of everyday activity, users can be provided with resources through which they can present themselves with less need for explicit authoring. This strategy was employed in the George Square blog (see A.1.2.4). However, the information presented in that blog was not tailored to the given audience. Instead, it was a 'one size fits all' reflection of an individual's visit to the square created post-visit. In George Square and Castles, the importance of ongoing adaptation of the user experience, in particular adaptation based on historical information, was highlighted. Other systems such as Shakra and Connecto have highlighted issues of privacy, reflection and repartee that were all also important to the design and development of both Ego and Egor, but this chapter concentrates on this idea of adaptation, providing players with a mechanism through which their own self-presentations are adapted and tailored to their audiences.

In life, one continuously adapts and changes how one acts depending on one's audience, as has been shown in 2.3. In Goffman's [68] words,

> *"When an individual enters the presence of others, they commonly seek to acquire information about him or to bring into play information about him already possessed. They will be interested in his general socio-economic status, his conception of self, his attitude towards them, his competence, his trustworthiness,"*

While this has long been recognised, our online presentations are decidedly static. The dynamism of our face-to-face self-presentation has not been translated to our online presentation. A 'one-size fits all' approach has several limitations. First of all, people are forced into predefined categories that may not appropriately define them [48]. The audience has to sift through information that is often not of interest to them to find what they wish to focus on. While both static and dynamic presentations can still create inappropriate presentations [36], those that are static are more likely to be left behind un-adapted over time and therefore misrepresent the presenter. When a platform such as a social networking web site is static, the users have to work hard at maintaining their profile if they wish to keep their presentations up to date with their ever-changing identities. This has been highlighted in [137], where Whitty notes that constructing a profile for online dating is a dynamic process, with interviewees reporting that they continually updated photos and text to try and attract others to their profile. However, as has been seen in Chapter 2, Grudin [76] notes that when this work is no longer done, misrepresentations are made but this time not through deception but through the failure of profiles to adapt over time. Pervasive and ubiquitous technologies are well suited to provide individuals with adaptive resources for self-presentation [90], providing context for tailoring one's presentation based not only on one's location and other objective features, but also on one's social context including the audience that views the information presented. By detecting Bluetooth devices associated with individual people and wifi access points associated with individual locations, Ego is able to tailor one's presentation (or *profile* in the Ego/Egor systems) based on a model of one's current interests and how those interests relate to those of other people viewing the profile. In the following section the design and implementation of Egor will be explained. Following on from this the Ego game will be described and Egor's role within the game will be shown.

7.1 Ego

In this section the author will discuss a multiplayer game, which combines both mobile and online play. The aim is to combine data captured from everyday activity in an online presentation of self that is tailored to the specific person viewing it, i.e. each individual among the 'audience'. This work draws on much of the work previously discussed in the thesis.

The importance of incorporating information captured from everyday activity can be seen in George Square and Feeding Yoshi and is reiterated by Johnson in his study of Facebook users [86]. He suggests that keeping in touch with others involves surveillance, seeing what others have been 'up to', how they look and how they behave. He suggests along with Walther et al. [132] that Facebook profiles serve as an important self-presentation tool. Through which individuals can build up social capital, investing in and maintaining ties with distant friends and contacts. Joinson also states,

> *"In many ways, this use of Facebook reflects the desire for 'perpetual contact', previously supplied by stand alone services like Twitter*[9]*"*

In recent years there has been a succession of social networking sites available on the Internet for maintaining relationships with friends, family and work colleagues. Their increase in popularity has been staggering. In July 2007, social networking sites occupied five of the top fifteen visited websites according to Alexa.com. On July 10, 2007, Facebook.com reported signing up its 30 millionth user, with a year on year increase in unique users of 89%[10]. In the UK, use of Facebook increased by 523% between November 2006 and May 2007[11]. Social networking sites have also opened up new avenues through which potential dates can be found and friendships made. The most popular include Friendster[12], MySpace[13], Facebook and Bebo[14]. These sites typically provide a similar set of facilities including user profiles, messaging services of various forms, facilities for uploading content, and the ability to make connections to other people. These connections are the core functionality of a social network site [38, 48] although most also provide opportunities for communication, the forming of groups, hosting of content and small applications.

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[9] http://twitter.com/

[10] http://www.techcrunch.com/2007/07/06/facebook-users-up-89-over-last-year-demographic-shift/

[11] http://web20.blogosfere.it/images/Facebook_Bebo.pdf

[12] http://www.friendster.com/

[13] http://www.myspace.com/

[14] http://www.bebo.com/

There has been an abundance of research done on social networking sites. Some have studied how profiles are constructed [48, 86, 137, 138] and the motivations for doing so. Some have detailed the limitations with having static categorisations needed for searching through individuals [48]. Others have focused on the difficulties of presenting oneself to multiple audiences with a single profile [36]. While some, such as the Cityware project, have tried to incorporate everyday activity into online presentations [90]. Therefore combining offline activity with online presentation is extremely important to maintaining these relationships.

The aim of supporting the presentation of everyday activity in Ego is not only for individuals to present themselves to others, but also to introduce accountability for what they choose to say about themselves. This accountability can also be seen in the studies of online dating websites. Both Whitty [137] and Elision et al. [48] recognise that while individuals play with presentations of self, the nature of online dating sites is such that the individuals want to eventually meet up and date those they are presenting themselves to. Therefore the level to which people embellish characteristics of themselves is restricted if they want to ensure their date is not disappointed when they meet face-to-face. It is this accountability that prevents gross exaggeration and outright lying. Whitty even goes so far as to state:

> *"The participants in [the] study were often outraged to find when they meet face-to-face that their date had misrepresented themselves in their profiles."*

The online daters in Whitty's study perceived honest and genuine people to be those who included in their profiles the traits or characteristics that they typically express in everyday offline social settings. When there is a discrepancy, as Goffman [68] would predict, the online daters in Whitty's study judged their dates as immoral, believing they had an obligation to match their impressions created in their profile. While traits and characteristics are difficult to capture especially for technology there is much that technology can capture that can be provided as a resource for outside observers to ascertain these traits and characteristics from. It is for this reason that bringing aspects of everyday life that can be recorded into online presentations can be extremely valuable, and Ego's game design aims to explore just this issue.

7.1.1 The Game

The basic premise of Ego is to ‘collect’ Bluetooth devices and wireless access points, to gain points and abilities that allow you to give points out or take points away from the other players. The game combines mobile play with online play. In the online section of the game, players have numerous pages through which they can keep up to date with the game play and their position in the game. They also have a profile on the website through which they present themselves to the other players.
On the Ego website players are asked to vote for who they feel has been to the most interesting places or spent time with interesting people, both of which are shown on their profiles.

For those playing Ego, the sole objective is to boost their ‘ego’ by becoming the ‘most popular online’, ‘most popular offline’ and the most 'worldly wise' player. These properties are improved in different ways; both ‘offline popularity’ and ‘worldly wisdom’ are improved through tracking done on the mobile device carried by users. In order to improve their ‘online popularity’ they have to convince the other players in the game to vote for them through the Ego website. The website provides users with several different resources—discussed below, that they can use to present themselves to others as they see fit so that they gain the correct kudos [132] and therefore votes for what they do.

To become ‘popular offline’ you must see lots of people throughout the day. By meeting up with people who have Bluetooth devices, a player’s 'popularity’ count goes up. To increase how 'worldly wise' one is, players have to travel around and, as they move around, the Ego mobile client tracks every unique WiFi access point seen and increases their ‘worldly wise’ score. Every day these scores are uploaded to a server, and players are given points based on which position they are in.

- First position receives 3 points,
- Second position receives 2 points
- Third position receives one point

As well as receiving points for this, the players also receive abilities that they can use on other players. There are three categories of abilities that are associated with each of the three scoring categories in Ego—‘online popularity’, ‘offline popularity’ and ‘worldly wisdom’.

- *Big up* - if you are voted one of the top three 'most popular online' on any particular day you get an ability to 'big up' a friend which gives them points, in turn, boosting their score. This does not reduce the score of the individual using the ability.
- *Knock down* - if you get an 'offline popularity' score in the top three on any particular day you get the ability to 'knock down' another player, which takes points from them reducing their score. This does not increase the score of the individual using the ability.
- *Insight* - if you get a 'worldly wise' score in the top three on any particular day you get the ability to see if another player has been hiding aspects of their activity but scores remain unchanged.

Both the *big up* and *knock down* abilities were direct products of trying to encourage the players to log information about where they went and who they saw so that they could use this for subsequent presentations.

The *insight* ability was designed to explore the issue of privacy. Throughout the game, players have the ability to hide or reveal particular aspects of their activity to explicitly control who has access to their information. By using *insight,* players are able to see information hidden from them. Although this was the case, as will be shown in the analysis stage, this insight ability became redundant since players did not feel that they needed to hide things and therefore there was never anything to see.

On the Ego website, there were several different resources available for users to view information about others and reflect on how they may be perceived by them. The aim of the website was to enable players to claim their identities both explicitly and implicitly through mechanisms that allow them to both *show* and *tell* others about themselves. By supporting the presentation of everyday activity in Ego and the tailored presentation provided by Egor gave the players the opportunity to 'show' what they do. The importance of this is highlighted by Zhao et al. in [138] where their study of Facebook profiles highlighted how Facebook users predominantly claim their identities implicitly rather than explicitly by *"show[ing] rather than tell[ing]"* and stress group and consumer identities over personally narrated ones.

In Ego, the website enables the players to view a scoreboard showing their current scores, and there are also a number of pages showing game statistics. The first of these shows how many points have been given out or taken away by each player—using the Big Up and Knock Down abilities. It also shows their top offline popularity and top travelled scores, allowing them to compare what they are getting with other players. There is also an events page on the website that documents the activity of the players, showing the abilities players used and who they used them on. By explicitly showing this information players were made accountable for their actions in ways that drew upon the examples of [42].

Figure 3: Ego profile. Profile image chosen by the user (1) Current location tracked by the mobile client, current mood as specified by the user on the mobile client, and blurb entered by the user on the website (2). Items in shared with the viewer (3). Current items of interest to the presenter (4). In game events of this player (5).

Each player also had a profile page that he or she could explicitly author (see Figure 3 points 1 and 2), however, the profiles also provided automatically tailored information based on their ongoing activity, using Egor (see Figure 3 points 3 and 4).

Each player could tailor his/her own profile by selecting a picture and writing a short piece of text about him/herself that would be shown to every player. The remainder of the profile focussed on dynamic content creation based on several different features. There were two parts to the profile, state information—information that was used to describe the current location and mood of the player—and historical information—information that is collated and aggregated over a significant period of time, such as what a player is most interested in and what they have in common with the particular audience—made up for a single individual in Ego.

The final section of the website was the 'Mirror' section. This resource provided each user with a means of self-reflection through another's 'eyes', in that it enabled one to view one's own profile, as another player would see it. This gave players the opportunity to reflect on what they should hide and reveal from one another when they were capturing what they were doing on the mobile device. In Figure 3 Jane looked at Graham's profile however, if Graham had decided to look at his own profile in the mirror section 'through Jane's eyes' he would have seen this exact page and therefore be shown what she could see which in turn might drive him to hide information in the future.

7.1.2 Technology

7.1.2.1 Use of Egor

When designing Ego several considerations about how to use Egor had to be made. What types of information should be logged? Would it be possible or necessary to support ad hoc peer-to-peer presentations of self? It was decided that location, people nearby and players' current moods were the most important features players wanted to present to others. Enabling users to view how others would view their presentations was also deemed important. Using Egor, this information was logged to a local database and synced with a central server so that it could be later used in the online profile presentations. Many of these decisions were made based on experience in designing and trialling the systems presented in this thesis although a small focus group was held that included five participants. During this focus group the interviewees discussed what they might like to present about themselves and their everyday activity online. They discussed photos, locations and their friends, and how they could show their interests and affiliations to others. While these were not new they reinforced that these were important in self-presentation. Reflecting on oneself also came out during these discussions and unlike everyday face-to-face interactions the participants recognised that they could reflect on

their presentations through the ‘eyes of others’ with one individuals eloquently stating, “I think I would like to see me as other people see me and not as I see myself”.

In order to support users in recording their everyday activity, the aim was to give them a commodity device that they could use without any additional technology (see Chapter 6). With this in mind, Ego was built to use WiFi fingerprinting to locate players—this is further discussed in section 7.1.2.2—and to share that information with others. As has been in seen in A.3 to enable scanning and data transfer a significant amount of management has to be done to make sure that the heavy weight scanning is stopped before data transfer. Since the priority in Ego was for individuals to mark their locations for others to see it was felt that this should take priority over ad hoc peer-to-peer presentations, since these could be provided by the server that also created them for those viewing the profile online. As has been in seen in A.3 to enable scanning and data transfer a significant amount of management has to be done to make sure that the heavy weight scanning is stopped before data transfer. Since the priority in Ego was for individuals to mark their locations for others to see it was felt that this should take priority over ad hoc peer-to-peer presentations that would be much less frequent due to the low density of users. This decision was also taken since the mobile clients would have to connect to a centralised server to support asynchronous presentations online anyway. However to simulate ad hoc peer-to-peer presentations, when players met up Ego requested that Egor obtain an updated profile from the central server. The mobile client also requested profile updates every 15 minutes, so that all the players’ individual state information could be shown. This information included their current locations, based on locations marked by the users themselves, and their current moods, as entered by the players themselves. While ad hoc peer-to-peer interactions were not supported in Ego this was due to a tradeoffs between technological constraints, and the author would advocate that in future systems this should be supported where possible to support unpredicted interactions.

7.1.2.2 Mobile Client

The mobile client was developed in C# and deployed on an iMate sp5. The mobile client itself synced with a central server enabling information to be shared between players. As has already been seen in A.3 supporting unpredictable interaction is very important when trying to support impression management. In Ego, this was supported using Bluetooth and Wifi scanning enabling people to make use of people they encounter and places they go throughout their everyday life in their online presentations. In order to support this, the

author created a Bluetooth scanner that could scan for nearby Bluetooth devices and use the Wifi driver discussed in previous sections to scan for wireless access points.

Figure 4: Ego client interface. Left: The main screen showing the current location, mood, popularity score and traveled score. This also shows the number abilities obtained and the number used. Middle: The actions that could be performed. Left: Other views that the players could see.

Bluetooth

The Cityware [90] project has used Bluetooth to capture the relationship individuals have with one another in the 'physical' world and present that relationship in the 'digital' world—in Facebook presentations. Users can see whom they encountered, when and for how long. If one recognises a device as belonging to someone one knows, one is able to 'tag' that device, thus linking it to a Facebook account and to that account's owner. However, Cityware requires fixed Bluetooth nodes to track everyone and infer from that data who is together. This requires a huge investment of resources to augment the world with these Bluetooth beacons. Instead, in Ego, the client itself logs other clients it has seen, and uploads this to a central store without the need for this extra fixed infrastructure.

The Ego Bluetooth scanner made use of the InTheHand .Net Bluetooth library[15]. The scanner itself set one's device to discoverable so that the other players could see it if they encountered it. This also raised an interesting point that while the players may have passed by many Bluetooth–enabled devices many may not have been on or at least may not have had their Bluetooth set to be discoverable. The scanner also sets the phone's Bluetooth name to the Ego username of the player. Once the scanner has found nearby Bluetooth devices, their discovery is logged in a local database and, when they were no longer

[15] http://32feet.net/forums/37.aspx

nearby, this is logged so that the length of time players are nearby can be calculated later. After this was logged, the system then tried to resolve the Bluetooth name of the discovered devices, so that their names could be presented to the user instead of generally incomprehensible MAC addresses.

Fingerprinting

RF fingerprinting techniques make use of the situated nature of RF beacons such as cell phone antennae and 802.11 wireless base stations. By detecting the IDs and signal strengths of these beacons, a unique pattern of cells and their associated signal strengths can be used to characterise an area. In A.6, mobile phone cell fingerprinting was used, based on GSM signal strength fluctuation. The phone used was again the iMate-sp5, which was able to detect up to seven GSM cell antennae. It compared these against a local database of fingerprints to determine the best match, and to determine the location tag associated with the fingerprint. The comparison was made using only cell IDs and required that a fingerprint from the local database must overlap by more than 60% for a match to be shown. While this worked reasonably well, it did not allow for the type of fine granularity some of the users requested.

In Ego, a similar technique was used to mark locations, however instead of using GSM antennae wireless access points were used. The provided finer grained positioning due to WiFi's more limited range compared to GSM antennae, but it is important to note that they can fluctuate more since access points can be moved between locations as well as powered on and off. Also, to improve the accuracy the similarity metric used to match fingerprints included not only access point IDs but their signal strengths. This prevented access points on the edge of a fingerprint from disproportionately affecting the fingerprint itself. While fingerprinting was used in Ego no formal evaluation of the positional accuracy was carried out. However, users reported it to be accurate to within a range of 5-20 metres. Although this technique was not formally evaluated the author considered many different techniques. GPS was considered but its reliance on additional hardware ruled it out early on. Other technologies considered included WiFi positioning and the author along with Marek Bell conducted several trials testing out a WiFi positioning system called Navizon[16]. However, after these tests, since Navizon required any area in which it was used to be war driven[17],

[16] http://www.navizon.com/

[17] Wardriving is the act of searching for Wi-Fi wireless networks by a person in a moving vehicle, using a portable computer or PDA.

WiFi fingerprinting seemed to provide the best solution and this was backed up after the trails. After the trials the fingerprints logged throughout the trials were fed into Navizon and only 60% of these locations could be located by the system. Therefore players would have been unable to mark 40% of the locations they did during the trial.

7.1.2.3 Ego Website

The Ego website was implemented using both C# and ASP .Net. The website was driven by a SQL Server database whose design was based on the Egor framework. The website allowed the mobile clients to use an HTTP Post to send data to it and update the database. There were several facets to the website:

- Scoreboard—the scoreboard showed the position of each player and how many points he/she had. On this page, players were represented on the scoreboard by the images they chose in their profiles (see Figure 5 left).
- Events page—this page showed all of the game events, such as when abilities were used on players (see Figure 5 right).
- Stats page—this showed the general statistics about who had used the most of each ability and who had achieved the largest 'offline popularity' and 'worldly wisdom' scores (see Figure 5 middle).
- Individual profiles—the profiles were driven by Egor tailoring information based on who was looking at the profile and what the person presenting the profile was currently doing.
- Widgets—there were three important small widgets on every page. These widgets were the profile widget to view a player's profile, the voting widget used to cast one's vote for that day's play, and the events widget that kept the players up to date with the last five events so they did not always have to go to the events page (see Figure 6).
- Mirror—this also used Egor, however it enabled people to look at their own profiles seeing how particular players might see it (see Figure 7).

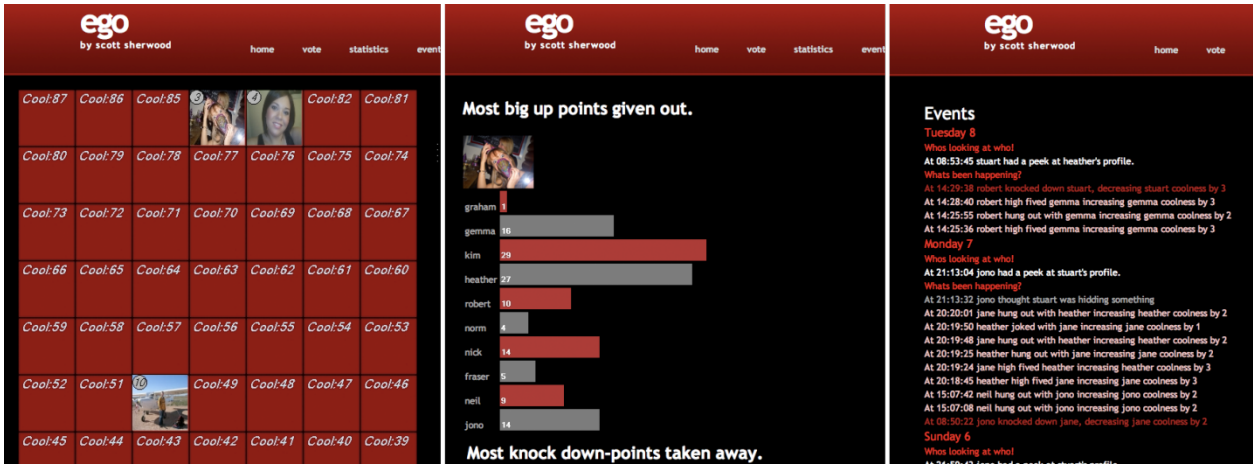

Figure 5: Ego Website. Left: Scoreboard. Middle: Stats page. Right: Game events.

Figure 6: Ego website widgets. Left: Other players playing, by clicking on these names their profile can be viewed. Middle: The voting widget. Left: A quick look of the last five events.

Before players could gain access to the website, they had to log in and answer the daily questionnaire. The questionnaire was required to be filled in once per day, and it gathered information on what players had been doing that day.

7.1.3 User Trial

7.1.3.1 Setup

In the Ego trials, there were two groups of five players. Groups of people were recruited who knew each other and who might feasibly be expected to meet throughout the period of play, thus providing opportunities for collaborative play. Within each group, most were well acquainted with each other and some were close friends, which ensured banter, competition and collaboration from the beginning.

Three trials in total were run. In trial 1, only the players from group one played. In trial 2 only the players from group 2 played In the final trial, both group 1 and group 2 played. Each of the three trials lasted for a two-week period. Therefore each player played Ego for a total of four weeks. This was to provide the players with a chance to play on multiple occasions, and to collectively develop tactics, strategies and a 'culture' of play, and it enabled the evolution of their play to be observed not only during a game but also between games.

7.1.3.2 The Players

Every player played in two sessions, but one player in Group1 dropped out after the first trial. He had been unable to cope with his college workload and subsequently dropped out of college and moved home. He was, however, replaced by another member of the group of friends. This new player was already familiar with the game as he was part of the same group of friends and saw them playing during trial 1 while spending time with them.

Teams	Females	Males	Age range	Trials played in
Group1	0	5	18-26	1 and 3
Group2	3	2	22-45	2 and 3

Table 2: Ego users.

The participants recruited came from a variety of professions. Group1 consisted of a group of students studying to become pilots. This group was a relatively newly formed group of friends with the individuals in the group only having known one another for approximately a year. Two of the members of Group1 shared a flat with one another. Group2 consisted of a marketing consultant, a company director, a beautician, a mobile phone salesman and a council worker. There were several different relationships within Group2. There was a husband and wife, a set of best friends and two who were work colleagues. All of the players in Group2 knew one another except for one who only knew one other player before starting the game. The players were all familiar with computers, using them on a daily basis either for recreation or work. Only two of the players did not own games consoles of their own, however all of the participants owned mobile phones and had at least one account on a social networking site, such as Bebo or Facebook.

7.1.3.3 The Method

The players were all compensated for their participation. However, to make the game more competitive, there was additional prize money for the winners of each round. FlexiFill was used to ask specific questions each day when players logged into the Ego website. Participants were also interviewed individually after each game, resulting in each player being interviewed twice: once about his/her group's individual game and once for the combined ten player game which saw the players from each group playing against one another. The system was extensively logged and a significant amount of data was collected to assist in tracing the teams' patterns of play. The players were also asked to fill out a short questionnaire that presented some of the pictures used throughout the game. The players were asked to state why they had chosen the picture they had and what they thought it said about them. They were also asked to say what they thought the other pictures said about the people who put them up.

Since the game required much of what the players did to be uploaded to a central server aspects of the game play could be continually observed and ongoing analysis performed that could in turn inform the interviews conducted at the end of the trial [119]. The interviews were transcribed and analyzed for common themes. The common themes looked for were informed by previous research discussed in the thesis and influenced by the topic of impression management.

7.1.4 Findings

7.1.4.1 Trials

First this section will outline the general features of the play across all of the three separate Ego trials. Following on from this it will continue discussing each of the three trials in turn highlighting the important features of each trial. This chapter will then continue discussing the findings drawn out of the three Ego trials discussing them in detail and presenting conclusions for impression management.

Across the three trials, two modes of play were observed very like those observed in Feeding Yoshi, called here *passive* and *active* play. The design of Ego afforded a more passive approach to play, with players taking the phones with them as they went about their everyday activity. This did not require the players to focus on the devices unless explicitly using their abilities on other players. The more active approach could be likened

to war driving or grinding[18] in games. When playing in this mode, players would actively go out and seek new places to collect 'worldly wise' points and 'offline popularity' points. This was often driven by competition between players.

Trial 1

The players in trial 1 employed a more passive approach to their play, taking devices with them but never going out explicitly to 'collect' Bluetooth or WiFi access points that would get them points and abilities. However, the abilities they did receive were used very tactically. Players reported that they did not consider using their 'Big Up' abilities, so they never gave anyone points. However, over both trial 1 and 2 we can see a similar percentage of Knock Down abilities being used. Their passive play meant that they could fit the game into their daily routine, taking it with them as they travelled to and from work as well as other places they chose to visit. The game became something that they could use to *'fill the time'*. Filling the time in this way became a common approach to playing the game.

While passive play characterised the interaction in trial 1, the players reported how the game and the features in the game became a conversational resource. They would often sit at lunchtime and view the Bluetooth names of the devices nearby, joking about them and speculating to whom they belonged. This conversation around the game was facilitated by the fact that two of the players lived together and that all of the players regularly saw one another in class. It was also a significant factor in them not using the Ego website as frequently as those in trial 2 with several of the players stating, that "most of the time" they "were all in the same group or in class" therefore they were constantly aware of what each other was doing. The game in trial 1 was seen very much as an individual game. This can be seen through Group1's use of their abilities. The number of 'Big Ups' given out was very low, however, the number of points taken away was much higher. This backs up their claims that the game was an individual game, with the players seeing the game "more as a competition between people [they] know". In trial 1, players were also held accountable for their actions, however, instead of these being in–game actions they were out–of–game actions. In one particular example, a player was held accountable for comments made

[18] Grinding is a term used in computer gaming to describe the process of engaging in repetitive and/or non-entertaining gameplay in order to gain access to other features within the game

during a class that saw players take points from him in Ego to show their distaste for his outburst.

Trial 2

In trial 2, the play was also mostly passive, although there were elements of more active play, with players regularly checking both the online and the mobile profiles. They looked at the mobile profiles 21.8 times on average as opposed to the 4.4 times in trial 1 and also logged into the website most days to keep up to date with the play. The difference in structure of Group2 is possibly the reason why they felt the need to continually check the status of the game play and the other players. Since they did not see one another regularly, Ego itself was needed to keep in touch with game play. Also, Ego became another way through which they could keep in touch with each other—as discussed later. While they were much more active in their play than Group1 and their average scores remained very similar, their maximum scores were smaller. Their game was characterised by team play, although in the end it was one pairing's downfall. Two distinct subgroups formed: one consisted of a husband and wife and the other of two best friends. The husband and wife pairing successfully collaborated and eventually one member from this subgroup won the game. The best friend pairing became impatient, with one languishing at the bottom of the leader board and, being mischievous, decided to take points off her partner. She stated,

> *"When we first started we were gona keep bigging each other up but then I just got really pissed off because I was still last and I thought I'm just gona knock down everyone and not big up anyone"*

There was also a significant encounter with the fifth member of the group, Graham, and one of the members of the best friend group, Heather. During the first week of play he had not taken many points from any of the players except from the player who he worked with. As the game progressed he thought he had managed to "ease" himself in and therefore felt it would be ok to take points away from one of the players he did not know. He proceeded to use several of his abilities to take points away from Heather. This prompted her to discuss the event with her friend, who was also Grahams colleague, which began a playful exchange where she suggested he had "hurt her feelings" on the website and her friend bantered with him during work.

Trial 3

In trial 3, both groups 1 and 2 played against one another and the more passive play of those in trial 1 changed. Instead of merely carrying the device about to gain points competition with new players drove them into a more active approach to play. The players also worked much harder to present themselves to those they did not know as well, so as to gain points and win the game. The use of their abilities in trial 3 was significantly higher than both trial 1 and trial 2, and the average scores gained were much higher. Again, playful banter and joking could be seen throughout the game, and elements of the players' previous play came through. The 'in game' happenings from both trial 1 and 2 were often referred to, for example, the incident in trial 2 that saw one player take points from another he did not know was highlighted in the profiles at the beginning of the trial. The woman who he had taken the points from stated, "please don't be mean to me this time! I don't deserve it!!!" Another player from trial 1 highlighted the joy that they had looking at the Bluetooth names in trial one, "loving this game, some of the Bluetooth names that appear on the phone are cracking. Have fun guys!" This player continued this activity in trial 3 and it evolved into him tagging those Bluetooth devices he saw regularly so that he could follow the activity of the *familiar strangers* [50] he spent time with.

Having two different groups in trial 3 also introduced a different game dynamic, which saw more collaboration However, unlike the more long-term collaboration in trial 2, this collaboration was a mix of both longer-term collaboration and shorter-term collaborations. Players would team up for a short time to exact retribution on an individual. Again, people were held accountable for both their 'in game' and 'out of game' interactions through Ego. As has been stated, the players worked much harder; often this was down to the competitive nature of the game and the friendly banter exchanged between the players spurring them on. While one might assume that the competitive nature afforded by the game would have seen the groups pit themselves against one another, this was not the case. While the discussion around the game shows that there were many different competitions that were ongoing throughout the trial both between teams and within teams, the way in which players used their abilities did not directly reflect this. If there had been a significant competitive element between teams this would have seen the vast majority of Knock Down abilities used on the opposing team, and the vast majority of Big Up abilities used on ones' own team (or not used at all—if playing individually). Instead, the Knock Down abilities were primarily used on Group1 by those within Group1. In contrast to this, Group2 rarely took points off one another and those that did faced retribution (see Table 3). For example,

one player took points off another in his team, and his wife, jokingly, threatened him with divorce if he did that againto her friend.

	Used on Group1	Used on Group2
Big Ups used by Group1	23	0
Big Ups used by Group2	1	34
Knock Downs used by Group1	23	6
Knock Downs used by Group2	27	2

Table 3: Abilities used by each group in Ego.

Finally, unlike trial 1 and 2, presenting oneself to others became an increasingly important factor in trial 3. Players took more time to craft their profiles using pictures, text descriptions, their location and their mood so as to present themselves to others in an appropriate way. The talk that surrounded the game also gave players a forum in which to discuss tactics. This 'backstage' [68] interaction was extremely important to maintaining a suitable, 'front stage' face, while also achieving one's goal—to win the game.

	Trial 1	Trial 2	Trial 3
% of Big *Ups* received that were used	34%	60%	88%
% of *Knock Downs* received that were used	65%	63%	89%
Average *popularity* score	87.26	99.48	133.56
Average *travelled* score	47.25	28.93	63.97
Max *popularity*	478	209	1221
Max *travelled*	296	206	371

Table 4: Ego statistics across the three trials.

Summary

The trials of Ego highlighted two modes of play: passive and active. These were characterised by the way players sought out Bluetooth devices or WiFi access points to increase their scores. Passive players did this implicitly, 'collecting' them as they went through their everyday life. Active players explicitly set out to collect them to increase their scores. While there were some periods in trial 2 when the players were more active, during first plays (trial 1 and 2) players generally tended to play passively. In trial 3, the play was much more active often through one-upmanship and the competitive element that drove the players. This also saw players bantering with one another and using their profiles to communicate, teasing each other with large scores and using abilities.

The trials also show the complex relationships shared within the groups. Players teamed up in pairs to collaborate, as well as larger 'gangs' to collaborate in long term and short term exchanges. In trial 3 inter– group collaboration can be seen although this was not overly common. Players tried to 'pick off' those marginalised by the other group and include them in their play so as to gain more allies and therefore more points and votes. However, the majority of collaborations were with those in the same team and most competition was with those in the other team.

While the game was competitive, players were very careful how they acted—not wishing to appear 'nasty' by taking too many points away, and feeling 'sympathetic' if they saw one particular player being 'picked on'. Controlling what one did became a large feature for the game play. This enabled players to influence others' perceptions of them, however 'backstage' preparation often allowed the true character of the players to come through. Presenting oneself is a continuous activity and even after the games, during interviews, players worked hard at this endeavour. However, this was not always done with aplomb and caused problems.

7.1.4.2 Supporting Multiple Personae

It is extremely important to control ones' own appearance, or apparent persona, in order to convey the correct or desired impression [68]. This is not always easy, especially when presenting oneself online, where information is no longer transient and is often made globally available [76]. Nevertheless, game players in general go to great efforts to create and manage multiple personae [36].

In [138], Zhao et al. note that Facebook users engage in targeted performances by blocking certain viewers from particular parts of their accounts. They go on to say that as people present themselves differently to different audiences—for example, people won't tell their neighbors everything they tell their family members— that they also expect Facebook users to tailor their online presentations to particular audiences. They go on to say that individuals in Facebook make clear attempts to reach out to people they are not currently friends with. It is understandable that there is information that people would not like to be shared with those they do not know. However, how can one be expected to tailor his or her presentation to show themselves in the best light to strangers when they do not yet know whom they are tailoring the information for? In Facebook, people often make their profiles public to do this but this can cause embarrassment if taken out of context and misrepresented (see Chapter 2).

Enabling players to incorporate aspects of their everyday activity into their online presentations, as well as using that activity to tailor what is presented, gives players a mechanism through which they can support multiple personae. Using this logged information, Egor was able to tailor the information given in the Ego profiles. In conjunction with this, the players themselves worked hard throughout their game play to control their appearance. The following section will look at how this was done via the users' profiles.

Profiles

Constructing a profile

The players in Ego stressed the importance of crafting a light–hearted and fun profile, to show that they did not take themselves too seriously. All of the players elected to have a photo, with all players (except for one) having text descriptions of themselves as well. The types of photographs were varied, including posed and natural pictures. Some showed affiliation and relationships to other players, those outside the game, as well as institutions such as football teams. Descriptions of the photos, communication with other players, tactics, game status and personal descriptions (that included jobs, hobbies and other relationships) were included in the profile 'blurb'. Players also appropriated these presentation mechanisms to 'chat' with one another, which was interesting but unanticipated by the designer A.3.

In Ego, the challenges to constructing an appropriate profile were similar to those of other social networking sites. In [36] DiMicco et al. recognise that:

> *"As the user composition of Facebook becomes more diverse, it will become more challenging for individuals to manage their personal identity within a website originally designed for the college years, but increasingly open to the post-college and professional years".*

Their study also highlighted individuals who purposefully 'cleansed' the information about themselves on Facebook, their blogs and their personal websites. One individual did this by taking off all of the pictures of him "drinking alcohol". This conflict between personal life and work life is something that has been seen earlier in 4.2 and this behaviour could also be seen in Ego. For example, the player who played with her boss did not feel that it was appropriate to put up playful yet 'risqué' pictures. She also tried to mediate the play by warning other players, saying that "my boss is playing" and that they should "behave". However, as the game progressed, her boss began using more playful pictures—which set the precedent for her to do so also.

Changing photos

The importance of the photographs displayed in the profile varied from player to player. Some players used the same photo throughout their entire four weeks of play, while others used many different photos, continually updating them and reacting to others' photos. In total, the players averaged 2.3 unique photos with a standard deviation of 2.26.

There were several different types of photos used in Ego. The pictures were both posed and natural. Some used pictures of objects such as a coffee machine, some used cartoon characters, and some used costumes and fancy dress Most of the pictures were shots of an individual, however a significant number of the photos were used to display affiliation to friends, family or organisations, such as football clubs. These pictures also included other Ego players, thus showing the connections between players.

At the end of the trial, the players were interviewed and given a short questionnaire about the pictures they chose and the pictures others chose. This questionnaire was designed to reveal why players chose the pictures they did and get their reaction to others' pictures. This was then further discussed in the interviews. It was almost unanimously stated that

players used their photos to show that they did not "take themselves too seriously" that they were "light hearted" and had a "good sense of humour". However, while this was the aim, it was not always how these pictures were received. For example, one player put up an image—downloaded from the Internet of a woman holding a cat with the caption *'Oh girl HOLD ON are those shoes on sale'*—and when asked why she picked it and what she thought it said about her she wrote,

> *"I thought it was funny and the caption made fun of me and my love for bags & shoes. Shows I have a sense of humour and I can laugh at myself."*

The comments from those whom she did not know were extremely mixed with some stating that she had a "good sense of humour", while others stated that she was a "rather unusual person" with one individual being extremely harsh in their criticism.

> *"[She was l]ooking for a better pic of herself because let's face it, it might be hard to get [a] decent pic!"*

This comment was made in the questionnaire at the end of the trial, and the player in question had put up a picture of herself by this point, which this comment reflects upon. Even the reaction from those whom she knew was mixed, with one individual suggesting that she was "possibly self–conscious". Another player she knew stated:

> *"She is trying to portray that she is your 'typical' fashionable stylish girl who loves shoes (Sex in the City type image)"*

The individual who made this comment knew the player well, and here seems to suggest that she is not like this image that she is using to portray herself, and instead of showing her true self she is trying to portray an idealised cliché Other examples of this included a player from Northern Ireland dressed in a kilt with a 'Scotland' T-shirt. Those who did not know him wrote that he was "Scottish & proud", however those that did know him jovially wrote "Confused. He's from Belfast. Good lad".

While these players appear to be misrepresenting themselves, they did not lie outright about their own personality or characteristics. Therefore, even though the other players noticed—as can be seen from their questionnaire and interview comments—they stopped

short of calling the players to account for their actions. However, as will be shown later, players who made explicit claims about themselves that were not true were held to account throughout the game.

The pictures were also used to express individuals' interests in particular activities such as shopping, travelling, drinking and flying planes. Again, while they aimed to present themselves in particular ways, this was not always achieved. For example, one player had a picture of himself dressed up as The Joker (from the Batman comics), and he had hoped this would show his fun and outgoing side. This picture recorded a significant event that he had gone to and was extremely proud of his outfit. He often talked about this picture to the other players and they even tagged him as Joker on their mobile client, i.e. his name was replaced with Joker.

> *Frazer: [I tagged Neil as the Joker] because he has a picture in his room and he is standing with his bird (girlfriend) and somebody else, and he is dressed as the Joker so I just put Joker in.*

However, while initially players felt this to be fun and playful Neil's continuous talk and boasting around this subject bored the players and saw him become the butt of jokes, with one player and his friend teasing him in the pub, trying to bring him "down a peg or two".

> *Frazer: "He kept going on about that day, he was going, 'it was so good being the Joker' so Ali and Nick were rippin' the piss out of him"*

Another example showed the relationship a player shared with other people. He decided to choose a picture, which was very obscure. Several of the players in Ego used photos that had underlying stories attached to them. These stories were not always obvious but instead encouraged other players, who may be intrigued by the choice, to ask about the specific picture. One player chose to use a picture he took in the changing rooms of the San Siro[19] stadium. In the following extract he explains why:

[19] The Stadio Giuseppe Meazza, more commonly called San Siro, is a football stadium in Milan, Italy. It is the home stadium for two of the three most successful Italian Football League clubs: A.C. Milan and F.C. Internazionale, and one of the most famous football stadiums in the world.

> *Graham: "I put one up that was a photo I took when I was in Italy but it wasn't even a photo of me it was a photo of a coffee machine in the gents loo which I thought was a weird place even if you play for AC Milan to have your cappuccino machine (laughs)."*

This obscure photo was coupled with a rather ambiguous profile text, aimed at tempting people into asking about the photo: "Which Milan players need coffee in the loo?" This player also used his profile pictures to show several of his affiliations, not only to the football team he supported but also to those he went to matches with, to work colleagues and to his family. Friends and family, including other players, featured in 39% of the photos taken.

Marking locations, Bluetooth devices and changing moods

Throughout the trial, players 'collected' WiFi access points and Bluetooth devices to gain points. However, when nearby Bluetooth devices were detected, the names associated with these devices (names given by their owners) were resolved, stored and shown to the Ego players. The players often noted that the "some of the Bluetooth names that appear on the phone are cracking (really good)", with several of Group1 often discussing and joking around with one another while looking at the names of the devices nearby. Throughout the trial 7962 unique device names were gathered. Between them, the players explicitly tagged 299 of these Bluetooth devices.

They tagged fellow players, friends and strangers. When tagging, players often used nicknames that they either already used or made up for the game, such as *'zebadee'*, *'polish'*, *'alpha ned'* and *'Ozzy dentist thief'*. The nickname *dentist thief* for example was derived from a story that Group1 shared about one of their members. This individual was studying in Scotland but had come from Australia. During his time here he had met and become engaged to a girl who was studying to be a dentist. However, his intention was always to go back home and hopefully take his future wife with him. The other members of the group decided that he was in fact planning on *'stealing our dentist'* by taking her back to Australia and therefore he was branded the *'dentist thief'*. Other names given were more descriptive especially when tagging friends and family out with the game for example, *'[jane]s best friend. gr8 fun'*, *'the wife'* and *'mum'*.

Another interesting use of Bluetooth tagging was the tags given to strangers. Group1 reported tagging people they did not know more than those in Group2. Not only did they regularly look at the Bluetooth devices nearby, they tagged them and in particular the devices they thought belonged to attractive women nearby, and included tags like '*shes beautiful'*. In trial 2, one player tagged Bluetooth devices by simply copying in the name of the device shown. He did not have to do this because the detected device name is always shown by default until a player explicitly tags it, in which case his/her tag is then shown. However, when asked about why he did this he stated:

> *"What I started doing with a lot of people is I would tag them, like, even people in a café I would tag them just with [their own device name] so that I had them tagged. It was quite interesting that even if I seen someone on the train I would tag somebody with [their own device name] and then the next day on the train I could see that I had seen that person before. [it was] Just interest that's all it was"*

This gave him an interesting insight into the world around him, and those that he inhabits it with, that he had not previously had [50].

Locations were not used as imaginatively as this. Instead, the locations players marked were either only 'endpoints' of a journey such as 'work', 'home' and 'apple store', or they included incremental steps as well as end points. For example one player who got the train to college marked every train station he visited on his way. The dynamic of the two groups can be seen through their use of locations. In their first trial, Group1 marked on average 2 (SD 2.3) locations. They noted that the close proximity in which they worked did not warrant them marking many locations to show one another. However, Group2 who did not work in such close proximity, and marked an average of 6.6 (SD 5.7) showing, in part, that they wanted to keep others informed about their movements. This trend was followed in trial 3, with its largely distributed population and the desire to show others their activity. The average number of locations marked in trial 3 was 8 (SD 6.04), i.e. the number of locations marked increased, and the number of locations marked became more consistent across players.

The final opportunity to use text on the phone was to enable players to express themselves, what they are doing, how they are feeling and why. The players themselves manually controlled this 'mood' area by adding their own texts—that were then stored so that they

could switch between them, as they felt necessary. The current text was presented on their profile. At the start of the game, each player was given a default set of 'moods' that they could use if they did not wish to add any of their own, these included, 'happy', 'sad' and 'tired'. The players created 95 moods, and switched them regularly. During the game the players used their own moods approximately three quarters of the time, The types of tags most often used were those that allowed players to express how they were feeling such as 'bored', 'sleepy' and 'hungover'. Players often complemented these expressions with additional information explaining why they were feeling this way. 'Hyper, to much coffee', 'pissed off missed the train' and 'happy dancing on ice is back on' are just a few examples of this. There are also examples of more risqué activities, however, one player quickly called this individual to account stating that, *'my boss is playing so behave!'* in her profile's text. This text was originally designed to provide users with another channel through which to present themselves in a more summative way. However, as has just been seen, the players appropriated it, using it to communicate directly with one another.

In fact, throughout the game, players had several different communication channels through which they bantered with and conspired against one another. This will be discussed later in 7.1.4.3. All of this information was used to allow players to present themselves in their profiles. Both the locations marked and the Bluetooth devices seen were used to drive the automatic tailoring of the profiles using Egor. Players were able to then see where others most frequently spent time, as well as who they spent it with, and how that changed over the course of play. They were also able to see what they had in common. This tailored presentation, as discussed in Chapter 6, was based on historical information, however the profile also showed more current activity including their current location—provided where they were was marked—and their current mood. All of this provided resources from which they players could get to know one another and use tactically to gain an advantage.

Awareness

In Ego, the dynamically tailored profile was used in a variety of ways. Players used it to keep up-to-date with those they knew, as well as using it to get to know those that they didn't. As the games progressed, players began to use the profiles more tactically. When playing in their individual groups, players were not as interested in seeing what they had in common. Instead, awareness of what others were doing was the priority. The following

statements characterise first plays, where the games only included people who new one another:

> *"I sort of knew what we had in common so I didn't pay much attention to it but I think if it had been random people that I didn't know at all I maybe would have been a bit more interested in looking. But because it was like friends [I already knew]."*

> *"I was very interested to see what they were doing in the game and how they were enjoying it."*

However, once the groups were combined to include all of the players, those within the same group knew one another but the groups did not know one another. Therefore the profiles were used much more to familiarise oneself with the other players. The following are accounts from two players, from Group1 and Group2 respectively.

> *"It was quite interesting just to see what they did in their day and how they were feeling, and that somebody would be in work and they would be bored or busy, or they would be out on the town having a good time."*

> *"I was more interested in seeing who they where, what they did, how they knew the other players and things they did. I was quite nosy"*

This awareness of the different people playing enabled the players to familiarise themselves with new players, keep up-to-date with their friends, also to glean information about the play of others.

Tactics: gleaning information

The players expressed that "knowing more about who you are trying to beat" made the game much more competitive. While the Ego profiles were initially designed to enable players to get to know one another and especially to help players decide whom they should vote for, the players quickly progressed to using them more tactically. In the early phases of trial 3, which contained the largest number of people that did not know one another, the profiles were used in this way. In "the beginning when everyone was close" they used the profiles to differentiate between players, deciding who should get their vote. Players

looked at a number of factors when deciding whom to vote for, including the profile picture, the profile text, what people had in common, where they went and who they saw.

However, the players quickly appropriated the profiles, using them in different ways. As the games progressed, players moved from using the profile to decide who to vote for, to using the score board to tactically decide who they should vote for in order to advance in the game. Then, the profile was used to glean information from the more successful players. The following account is indicative of those that expressed this type of play:

> *"If you know where [other players] are and what they are doing [I was] thinking right where [are] they getting points, [such as] popularity points, [for example if] they are out in the town on a Friday night they are gonna be getting lots and lots of points probably"*

By seeing where people had been and where they currently were through the profiles, players were able to work out how much effort they might have to put in order to make sure they achieved a higher score than their opponents that day. There were several accounts made by players stating that they were able to make use of this information to improve their own scores. For example, one player (Stuart) achieved an extremely high popularity score at the beginning of trial 3, achieving a score of 1221, which was the highest of all three trials (see Table 4). Several players commented on this score, and noted some of the locations tagged by this successful player. The following account shows a player noting where this individual went and how this information was used to boost his own score.

> *"[I was] just picking up points in hot spots like the apple shop, [it] seemed to [be good there since] that's what Stuart was doing."*

In Section 7.1.4.2 (see Changing photos), it was mentioned that players were held accountable for the pictures that they chose. In a similar way, they were accountable for the tags they made. In the previous example, the player notes how he copied the play of another more successful player. By noticing on the profile where the latter played, the former player was able to go to the same places to 'collect' Bluetooth devices. Since the marked locations were shared between players, when this player reached the area that he thought the tag represented he saw that he was indeed in the correct position. This

accountability made it difficult for players to try and mislead other players by tagging locations with incorrect names.

Mirror

Reflection

As discussed in Chapter 3, self-reflection is extremely important. For that reason, Egor has a reflection mechanism built in **Error! Reference source not found.**. In Ego, this was presented to the players as the 'mirror' page on the website. This page enabled players to view how their profiles would appear to others. For the static elements, such as their photo and text 'blurb', this would not be presented differently to different players. The automatic elements such as their current locations and moods would be shown in the same way to every player. However, players could choose to hide this information from other players. The latter would see that the location and mood of the person being viewed were 'Unknown'. When viewing the history–based elements, the player would see items of common interest to both viewer and presenter. Again these items where only shown if the presenter had not chosen to hide them from the particular viewer. Therefore, through the 'mirror' one could see one's presentation through the eyes of any of the other players.

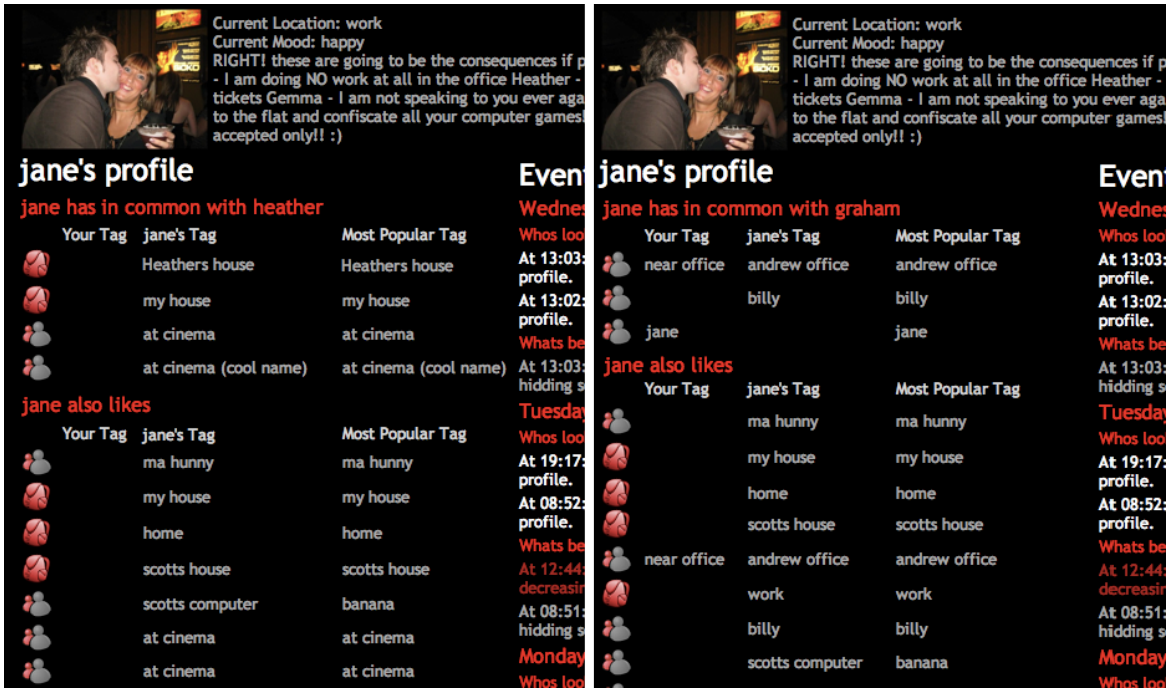

Figure 7: The profile of one Ego player as seen by two different people at the same time. On the left is the view of her close friend and on the right is the view of her boss.

Similarly to the way that users could check that marked locations had accurate tags, players could use the mirror to check the results that were produced by Egor. They often noted that they recognised devices shown as part of their profiles,

> *"There were a lot of [people] that I recognised that I had [on my profile]"*

Also, throughout the initial games, where players knew one another, players stated that they recognised the items shown in the profile as things they genuinely had in common with the person who owned the profile being viewed.

> *"Most of the time because we were all in the same sort of group, or in class, and even at lunch times and all that, we were only hitting the same people up [logging the same people around about] so most of the time especially myself and Frazer were always really, really similar"*

While this was often redundant, as they knew what they shared, it helped build up confidence in Egor. This, in part, may account for how little they chose to hide from the players encountered in their second plays.

However, there are also other privacy factors that may have influenced this. Players noted that having the mirror feature meant that they could check what was automatically being shown about them. They also noted that while Egor was automatically tailoring their presentation for them, they had control over much of the information that went into making up the profile, in particular the places that they visited. Many players noted that they had control over the places they marked, so if they did not want people to see where they were then they would simply not mark the location.

This control given to users, to hide or reveal information, is important to impression management and can be readily be seen in games where bluffing is an integral part of the game [71]. This, coupled with the ability to reflect on potential presentations through the mirror, was extremely important in facilitating this building of trust in the decisions made by Egor. Even though players only explicitly hid information on very few occasions, it appears that having that choice meant that any privacy concerns were removed. It is important to note though, that by choosing not to mark locations, hiding may have been done implicitly by players.

7.1.4.3 Adapting behaviour

Acceptable behaviour

Supporting multiple personae went some way to enabling the players to present themselves in a suitable way to others. However, players also had to work hard to present themselves correctly to others, both to preserve face and to be successful in the game. For example, one player reported that she did not take points from other players because she felt that they might think that she was a "cow". On other occasions, players explicitly mentioned that they did not want to embarrass themselves. One player mentioned that he only put a picture of himself in a football top up after he had 'eased' himself into the game. In the following extract, the player notes how she decided not to put any playful pictures of herself up until after her boss put one up:

> *"The only reason I changed my picture as well was because [my boss] put up, like, he had a normal picture at first and then he put up one of him and [his daughter] making stupid faces and I was, like, he is obviously putting up stupid pictures so I put that one up of Heather and I in the loft. Because at first I was, like, I'm not putting up anything like that because if Graham looks at that he will be, like, 'what the hell', but when he put that one up of him and Samantha I was, like, oh well."*

The photo in question here was taken in a local bar while she was out with a friend. The picture itself showed her with her head in her friend's bosom. It was obvious to see why this picture was not deemed appropriate for work colleagues but once the precedent had been set there was no longer an issue.

Hidden talk

The use of 'hidden talk' was also extremely important to manage one's impression in the game. Players would use a multitude of different communication channels through which they bantered and schemed. In Goodwin's analysis of 'he said she said encounters' [72, 73], it is the revealing of hidden talk that sets up these encounters. Those who make utterances about others are brought to account by the third party 'informant', which can often be damaging to the individual who made the original statement. In [68] Goffman also talks of hidden talk or, more particularly, secrets and the damaging effects as a resulting from secrets being revealed inappropriately:

> *"A basic problem for many performances, then, is that of information control; the audience must not acquire destructive information about the situation that is being defined for them. In other words, a team must be able to keep its secrets and have its secrets kept."*

Throughout their play in Ego, players also had to maintain many different 'secrets' or hide information that might be damaging if revealed. In order to keep maintain this secrecy, many different modes of communication were used so that access was controlled and particular players were not privy to damaging information. This hidden talk via private and semi-private channels was a key feature of play, especially in the third game. Throughout this game, the competitive spirit drove the players to try and beat one each others' scores each day. They shared banter with one another through their profile texts. These exchanges were not restricted to the game system; they spilled out into casual conversation between players who regularly saw one another and also into other communication channels such as social networking sites.

The following is an example. During the game, the players strived to collect as many Bluetooth devices and wireless access points that they could. This race enhanced the competitive edge between the players. In Group 2's first game, the highest score obtained was 409. So, in the third game, when Jane noticed that Stuart had achieved a score of 292 she, jokingly, suggested that he was cheating in her profile, opening up what was to be a long exchange between the pair. The day after this, Jane went to a football match between Scotland and Croatia (attendance 25,000), and in this environment she was able to collect a significantly larger number of Bluetooth devices than she had previously. This meant her score shot up to over 665, which she was extremely pleased about, prompting her to respond to Stuart's score by writing in her profile:

> *"[N]o more Mrs nice girl!! And me and the BF (best friend) will be collaborating ;) Oh also 665 popularity score HA HA HA HA HA HA!! P.s Gemma stop high fiving Stuart, he is CLEARLY well ahead of everyone!! :op"*

This response simultaneously states her tactics, chastises a friend for working with the enemy, and teases Stuart about his score—noting that she had beaten it by a significant margin. Over the days following this Stuart managed to pull further ahead, and Jane sent a SMS message to Heather highlighting this and discussing tactics:

> *"Stuart is miles ahead now! Why is everyone bigging him up when he is clearly winning! Argh! I'm just voting for you now :o)"*

This message was the first of many private messages between Jane and her team mate Heather. In this message, she first reveals the state of the play then questions other players' actions, and finally she states her intention to disregard all of the other players except for her friend. Keeping this message private meant that she could later call on the help of her group, even though she knew she would not help them without some payoff in return. While Jane had been teasing Stuart on her profile about his scores, he had remained relatively quiet as this exchange unfolded. However, the following day he obtained a score of 712 and promptly updated his profile:

> *"WWWHHHHHHhhhhhooooooooo!!! Check out my popularity Jane! I'm beating you! You'll need to get out of bed a bit earlier tomorrow to beat that one! Teechee"*

While Jane and Stuart were in different groups they were the only two people that knew one another across the different groups. This meant that they shared access to one another's social networking sites. And, after seeing this score Jane proceeded to post on Bebo for Stuart and others to read:

> *"YOU ARE A BIG EGO CHEATER!" to which Stuart responded "how'd I cheat you're a sore looser jane xxx PS. love the photo haha!"*

This exchange is typical of the banter shared between players in Ego, however it is important to note that this accusation is done outside of the game in their semi-private social networking space. While Jane questions how Stuart got the score in her Ego profile, she never explicitly calls him a cheat 'publicly' in the game. It may have been that this comment was made out with the game so that Stuart wasn't embarrassed by the accusation. It may also have been so that the Jim wasn't perceived as being a bad loser. It is difficult to say if either of these hypotheses are correct, but what is clear is that players choose different ways to communicate depending on the forum they are in.

Later that day, Jane updated her 'public' Ego profile:

"STUART!! What are you playing at…….over 700!! The only reason I managed that is coz I was at Hampden – where the hell did you go??! Where you a total saddo (a sad person—someone leads a boring life) driving around town for 5 hours? ;op"

This player suggests that those who invest large amounts of their time in the pursuit of Bluetooth devices in Ego must have little else to do, therefore she implies that he is a dull and boring person. The comment itself is formed as a joke but, underlying this, she seems to be trying to shame Stuart into not playing in this way, because she cannot achieve the same scores due to her work constraints. While these events unfolded, Stuart had been gathering popularity points that day and uploaded the largest single day's score of the entire trial by any player (1221) The following day he took great delight in pointing this out to Jane when he was talking to her on Bebo:

"Jane have you checked my popularity for yesterday yet??? beat that one :-)"

To which she replied with:

"RIGHT! wait a feckin minute here!! How the hell did you manage that? I was at Hampden for the Scotland game with thousands of people the time I got 665 - what the hell can you possibly be doing to get 1221?? I used to like you"

She changed her Ego profile 40 minutes later to:

"STUART!! What are you playing at…….over 1221!! The only reason I managed 665 is coz I was at Hampden – where the hell did you go??! Where you a total sado driving around town for 10 hours? ;op"

The change to her profile here is extremely subtle. She changes his score from 700 to 1221, she adds her own score of 665, and ups the time she felt it must have taken him from 5 hours to 10 hours. The score update highlights Stuart's score for those who may not have noticed it in the stats page. By adding her own score, she gives any reader a reference point from which to judge the severity of the difference. Finally, she tries to suggest that he must be even more boring and dull than before spending all of his day 'collecting' Bluetooth devices. This also prompted a series of SMS messages between both Jane and Heather,

where Jane updated Heather on the score, and Heather expressed that she also thought he was 'cheating'.

The continuous questioning and accusations forced Stuart into explaining how he was able to achieve such a high score. However, this explanation was only provided to Jane via a Bebo discussion rather than being made available to the entire group:

> *"I guess I'm just lucky! I walk through the town twice a day on way to school and home... I also took a trip through Buchanan Galleries.... I'm sure someone will [take points from] me tonight to make up for my popularity being so high. PS. I'm on about 800 for today so far... with another 6 hours on the clock! n xxx"*

At this point, he was very far ahead of her and may not have perceived her as a threat. Again this explanation is semi-private, so that he can account for his actions and appease Jane's suspicions without revealing his tactics to everyone in the game. She then proceeds to reiterate her suspicions and notes that if he is telling the truth then he is at an *'advantage'* and therefore he *"should have points deducted"*. This is followed with this reply on Bebo:

> *"oooooohhhh check you out... missus JANE!!! I'll take my ego to a football game and collect thousands! Anyways Starbucks was jam packed! So I went to Costa in Waterstones! and the Apple Store! N x"*

He teases her for not believing him, but he still proceeds to explain in more depth how he achieved his score.

This example spanned three of the players with two directly bantering with one another. Another shorter incident also took place with four of the members of Group1. This took place near the end of the third trial. All of the players in this group ganged up on Stuart because he was very far ahead of everyone else. Jono, as seen in the previous example, used SMS to "rally the troops" against Stuart, to take points away from him and to eventually enable Jono to over take Stuart, however, while this happened both Jane and Heather also put their plan into action and leapt above both Jono and Stuart—but Jono did finish in third place. This incident is discussed further in the next section.

7.1.4.4 Affiliations, Relationships and Gangs

In Ego, 'gangs' were groups of people that teamed up to collaborate in a particular action. The duration of these groups was some times short–lived, and on other occasions they were much longer lasting—often reflecting a stronger underlying relationship between individuals within the group. Also these groups were often pairs of individuals, instead of larger groups.

Short term

Throughout all three trials, there were short–term collaborations, with players teaming up to the advantage of them both—often to take points away from those at the top of the leader board. In trial 1, Neil was always second to Stuart and as a result tactically voted against him. In this game, Neil tried to exploit Craig, who was last, trying to bribe him into "big[ing] [him] up because Stuart was so far ahead". This type of exploitation of the player who was last was also seen in trial 3. In this instance it was Neil who was last, which was the result of his own team taking lots of points off him. There were many reasons for this, but these will be discussed in 7.1.4.4. This prompted two members of the other group—Group2—to try and use this to their advantage, suggesting *"come and join the 'cool gang' and vote for Jane and Heather and we'll get you back to being cool!!"* Approximately 2 hours later, Neil wrote this message in his profile:

> *"Alright enough of this we need to start some tactical voting to get back at Stuart. The baw bag"*

This response is very carefully phrased. He does not explicitly state that he will team up with them, turning his back on his own group. Instead, he acknowledges the fact that he will work against Stuart but this is different from working with them. It can be seen in the log data that he never votes for either of these two players, and in fact he only ever votes for the players in his team except for Stuart. Also, as this trial neared its conclusion, Jono, a member of Stuart's group, was close behind him in second place. This prompted Jono to "rally the troops" against Stuart. Unlike the 'public' attempt by Jane and Heather to recruit Neil to 'gang' up on Stuart, Jono did this privately using SMS. He sent out a message to those in his group stating that they should all use their abilities to take points off of Stuart and therefore increase his chances of winning. His reasoning for 'turning' on Stuart was two–fold: he wanted to win the game, but he also noted that Stuart had boasted throughout

the trial about the popularity scores he was managing to get, and therefore wanted to teach Stuart a lesson:

> *"[H]e was showing off and that he was coming first and that's when I though oh I'll I fix this!"*

Stuart's continuous boasting in class meant that the other players were happy to help Jono in this instance. At the same time, Jane and Heather put their 'master plan' into action and used a significant amount of their abilities on Stuart, causing him to fall even further down the board. When he saw this, Stuart became very upset and did not speak to the other players in his group because they had ganged up on him. The following extract from one of the interviews shows a noted change in his behaviour.

> *"He spat his dummy. It's quite funny actually … [He stopped talking to us in class] He wouldn't even turn round [and] he wasn't even doing his stupid things in class. [For example] he has these habits of answering his phone during class when people are doing a lecture, and yawning, and he starts whistling to himself, and everyone is like shut up mate but [he even stopped that]. He was completely bummed out"*

Boasting about his in–game activities made him a target to be taught a lesson. Players taking retribution on each other is something that will be discussed further in 7.1.4.4.

Longer term

The short term 'gangs' were formed explicitly to rein in those out in front. Other gangs were formed that reflected the relationship shared by those within the group. For example, in Group2 there was a set of best friends (Jane and Heather), and a husband and wife (Robert and Gemma). As trial 2 progressed, these two distinct subgroups emerged. However, Robert and Gemma reported that this had happened coincidentally, as they had no plan at the start nor during the game to work together. On the other hand, Jane and Heather had planned to work together but it all went wrong. The reason for this was that Heather fell down the leader board, and became impatient at languishing in the bottom area of the game.

"When we first started we were gonna keep bigging each other up but then I just got really pissed off because I was still last"

Mischievously she thought it would be fun to 'Knock Down' Jane's points using one of her abilities. This resulted in an exchange in which the two players took several points off one another. In fact, Jane took points of Heather on three occasions and Heather took points of Jane on four occasions. After the first week, Jane then noticed that "something weird was going on" as Gemma and Robert were at the top of the leader board. She concluded that they were collaborating and tried to get others to take points away from them:

"It was only [in] the second week [when] I thought 'there is something funny going on there' because [Gemma and Robert] went miles ahead of everyone else and I was, like, there is something weird going on."

The closeness of the relationship they share can be seen through their collaboration in Ego. Each day, players could log into the website and vote for the other players. They had to vote for three players, ranking them first to third. On the days they voted, both Gemma and Robert ranked one another first 100% of the time, with positions two and three distributed evenly amongst the other players. The use of their abilities also shows this collaboration. Gemma used 25% of her Knock Down points on Robert, while he only used 14% of his on her. She used 48% of her Big Up points on Robert, with him using 93% of his on her. They noted that they knew who to vote for:

"[W]e knew who to vote for and who not to vote for to move us further up the board We knew to vote for each other because that pushed us up the board, so…"

The Knock Down abilities they did use on one another were used near the beginning of the trial. Many players throughout the trials noted that they used these against players they knew at the start, as they did not feel comfortable taking points away from someone they did not know. However, as they got to know the other players through Ego, they no longer had this inhibition. Gemma's unease with taking points away from others could be seen during the interview. When asked about this, she noted that she felt that it was "really mean" to take points from the other players, and tried to detach herself from the action stating "we did what we had to do". Other players also noted feeling "quite bad" about taking points from players they didn't know. Once Jane noticed the collaboration between

Gemma and Robert, she began saving her abilities up so she could take points off them near the end of the game, so as to win. However, like Gemma, she did not feel comfortable with this and subsequently did not go through with it at the end of the game—even though she would have won if she had done so.

> *"[I saved up my knock down abilities] because my idea was if there was one person or two people ahead of me, say I had ten, I was gonna split them up or [use them on] one person if they were ahead of me but then I felt bad and I thought I can't … because it comes up on the website so if they would have checked it they would have seen [what I had done] and they would have been, like, she is a cow."*

Indeed, at the end, she had 8 Knock Down abilities left, that attributed for 73% of all those abilities that she received. Working together could make a group a target, or it could be used to hold other players' actions to account. How the latter was done through Ego will be discussed in the following section

Retribution

The game itself also provided a forum for holding people accountable for their actions. In Ego, it can be seen that players not only held players accountable for their in–game actions but also for their out–of–game actions. Often in–game actions could be see as a 'tit for tat' exchange, where if one player took points off another, they could be sure that at a later date this would be reciprocated:

> *"If I went on and saw, say you [taken points off] me last I'd [use my abilities to get] you back"*

This could also be seen when giving points out to another player, which was often met with the same gesture in return.

> *"If I was gonna [big up] Frazer or Jono they would big me up back"*

These actions were directly related to playing Ego, however punishment or retribution for actions that occurred out with the game were also a very common feature of how Ego was used. During trial 1, Frazer became embroiled in a dispute with Neil. The dispute was over comments made to their lecturer; Neil had accused her of not teaching them the full course:

> *"Nobody pissed me off, apart from Neil. He spoke to [the lecturer] and really had a go at her about [how she hadn't taught us the whole course]. It really hacked me off something awful."*

Since she had become friends with the class members, and often socialised with them, Frazer felt the need to defend her. This meant that he did not speak to Neil for several days during the trial, and he used all of his Knock Down abilities on Neil during this time to show his displeasure.

The aim of designing Ego was to test out Egor and its ability to help in tailored online presentation. While this was the case, the game also highlighted the continuous nature of self-presentation. This was highlighted while the interview process was in progress after trial 3. During the game, Neil had finished last after the players from his own group took many points from him. They felt he had become 'cocky' about the marks he had achieved as part of his college course. The post–trial interviews each contained two of the participants in them, and therefore Neil was interviewed along with Nick. During this interview, Neil himself expressed why he felt the players from his own team had ganged up on him:

> *"As you know I [had the most points taken from me this was] because I am doing the best in the class [and] you're all just jealous"*

But Nick responded by saying,

> *"After a while it just got funny and I think everyone was, like, ah… get him"*

It would seem from this reply that Nick knew that the comment was made in jest, and was joining in joking about the incident. However, while this comment was made in jest, Nick reported back to the college class, the following day, that Neil had said he was better than everyone in the class. He did not make reference to this comment being made in jest and it sparked a debate within the class[20]. During this discussion there were approximately nine

[20] This incident was witnessed directly by the author, as the discussion started at the time the author was on the way to interview two of the other players.

people in the class, four of which had played the game. However, Neil was not there to stand up for himself.

This incident highlights the damaging nature of misrepresentation, especially when one is not aware of it. In the interviews that followed this incident, the players made explicit reference to Neil's academic ability, and there were some very detailed descriptions about who was the best in the class. The descriptions were constructed to position the speaker as one of the top in the class, but every member stopped short of stating they were the best. This prevented any of them from being held to account for their comments in this way. Paradoxically, one of the main criticisms of Neil was not that he was better than the other players but how he went about expressing it:

> *"Usually he dumbs it down like if he has an exam he is like 'I'm gonna fail this, I'm gonna fail this'"*

Another player stated,

> *"Then he'll come out with like 97%, it would be better if he just came in and said 'Look, I'm confident about this' then we'd be, like.good for you, well done. I'd love to be confident. I'd be boasting about it if I was confident (laughs)"*

While the members of this group teased Neil about these actions, as has been shown they used Ego to exact retribution on him. On one occasion, Neil made a comment in class deemed to be stupid, and this prompted Stuart to use one of his abilities to take points off Neil. When doing so, he tilted the screen to show Jono, who proceeded to copy this gesture and also take points from Neil. Some of the players from the opposing team noticed this, and tried to utilise this to their advantage by trying to get Neil to help them. However, Stuart stated why this might have been:

> *"[T]he first time you sort of encounter him, you think he is actually OK apart from his dodgy looks and goofy teeth which are yellow and crooked… [However], he has got the worst patter I have ever heard in my life. He just sits in class and is arrogant."*

It was interesting to note how people perceived one another through the profile photos in this way, and Neil himself even noted that it may have been his photo that made him a target—which would have explained the jibes about it in the first trial:

> *"Yeah, I was like at negative 20. I don't know, maybe it was the wrong photo or something"*

These events shows how real world events were made accountable in the game, and how people made use of jokes and fun to express their true feelings in a way that would not make them look bad, or upset the individual they were aimed at. Remorse also played a part, with some players trying to make amends, such as Jono who ended up giving out as many points as he took away. The other team also tried, in vain, to 'turn' Neil using his teammates' actions against them and recruiting him into their own team.

7.1.5 Conclusion

The chapter has built upon the work of George Square, Shakra and Connecto, using the ideas for tracking and recording information so that it may be used in self-presentation and to drive the tailoring of these presentations Also the work done in Feeding Yoshi and Castles influenced the design and implementation of both the Egor framework and the Ego game. Like the previous chapters in this thesis, this chapter will be discussed on three levels so as to address the three research questions outlined in 1.5.

The author has shown how recorded information was used to present oneself to others. This recorded information drove the tailoring of the presentations and enabled those who were familiar with the presenter to keep up-to-date with the ongoing activity (see A.6). The players themselves were encouraged to use aspects of their everyday activity in their profiles, highlighting what they felt would gain them kudos with the different members of the game. It has been shown how users worked in parallel with the Egor tailored presentation framework, to update and present appropriate presentations. This tailored information meant that players could familiarise themselves with those they did not know and slowly reveal aspects of their profile as relationships between the players built up.

In answer to RQ1, the players could be regularly seen using the information recorded throughout the trial as a way of initiating conversation with those they did not know, as well as using it to present themselves to others. This could be seen in how the players

crafted the tags they used in their presentations to encourage intrigue between their fellow players. While the users had significant control over the information logged, Egor provided them with another level of privacy. By tailoring the presentation to the audience misrepresentations could be minimised and information that was not of interest to the audience could be filtered out. While it is difficult to show conclusively that Egor did not present information that it should not have, the players reported that when they used the 'mirror' section of the website no information was shown that they would rather have kept private from that particular person. At the same time, many of the players reported that they recognised things that Egor showed them as having in common with others. This automatic tailoring supplemented with the explicit control given to the users to hide and reveal information if needed proved to be a valuable resource.

In A.3 the author advocated design for unanticipated use, which is a feature of many of the systems discussed in this thesis. Ego was no different. With regard to RQ1 users used the recorded data in others' presentations to copy their tactics. One player explicitly reported using the places shown on a successful players profile as indications of where it was best to play to gain points. While players could glean information from the profiles and use it to their own advantage, the profiles also provided the presenters with the ability to account for their large scores. For example, the places a player had gone were shown on their profile (provided they marked it), this gave the players the means to disprove any accusations of cheating made against them. This accountability and the need to be able to produce accounts when called into question are also discussed in 2.1.1.

The design of the game meant that players' actions would often be held to account in this way. Even actions out with the game were held to account through the use of the game. This chapter has shown several examples of this in 7.1.4.4. The explicit in game feedback made the players reflect on the potential outcomes of their actions, thus adhering to the suggestions made in several of the previous chapters where the significance of reflection has been discussed in detail. Players could not only obtain feedback of events that took place within the game but they could also reflect on their self and the presentations they were making to others through the 'mirror'. In answer to RQ2, and following on from the conclusions of several of the previous chapters, such reflection is extremely important for designers to support and is reiterated here. While such reflection and feedback is imperative, in Ego some of the players tried to devise ways in which to 'hide' information made public. This strategy appeared to be somewhat misguided however; it did revealed

subtle nuanced behaviour in how the players used the resources available to them, and again highlights how unanticipated use of systems designed for everyday life emerges (see A.3).

This chapter also built upon the need to support mutual awareness and sharing of information at a distance as highlighted in Feeding Yoshi. It was often the case that players would use the system to keep-up-to-date with the other players in a similar way seen in Connecto. This increased awareness helped the players adapt their tactics over time but it also gave them more of a feeling of connectedness to those that they were not often in contact with or did not know before the trial began. This was played out throughout the game and could be seen through the groups that formed for both short and long term collaboration before falling away. This encouraged collaboration and interaction between those playing Ego particularly those who did not know one another. While providing information to individuals separated by time and/or space, raised several issues in Chapter 3 such as privacy and reflection. The desire to control who could access what information was extremely important and has been seen in many different studies discussed in Chapter 2. The author has also shown how revealing information to an inappropriate audience can lead to misrepresentations that may be costly to the presenter. Therefore when supporting mutual awareness of groups of individuals, especially when these groups are made of many different subgroups—friends, family, colleagues and strangers—it is important for designers to realise the need for tailored presentations based on the audience as the author has already stressed. With regard to RQ3 the author has proposed architecture, Egor, to help over come this and in answering RQ2 suggests that designers should support users not only in tailoring their presentations but also suggests the need to present multiple personae in digital presentations.

By using the Egor architecture, presentations could be automatically tailored to suit the audience and therefore provide support for these multiple personae. However, Egor also offered several other facilities that supported multiple personae. The architecture itself enables significant feedback for presenters, enabling them to view presentations that will be made to others. Reflecting on presentations in this way not possible in face-to-face communication, as it is difficult to view ones own embodied presentation. The Egor architecture was explicitly designed to make use of actions and interactions in both the physical and digital seeing them as complementary rather than separate Chapter 2, with actions in one explicitly being used to tailor the other. Technology or architectures that

help online presentation make use of mobile everyday activity to reflect the 'true character' Chapter 2 of the individual that the profiles represent over time. This reduces the load on users who wish to keep an up to date presentation as it is driven implicitly by their actions. With respect to RQ2 designers must carefully craft and tools that enable users to make use of their everyday activity into digital presentations which will reduce the over all work load needed to maintain a digital presentation.

These tools include feedback and control mechanisms as discussed by Bellotti & Sellen [8], so that individuals are not only made aware of what others are accessing but also given control to adapt and change how this information is presented, through the use of mechanisms to hide and reveal information. In doing this, designers must recognise that their systems only make up a small part of the overall picture, in Ego the game was played out, not only through the mobile client and webpage, but also through a multitude of other communications mechanisms that were used to keep up-to-date, scheme, strategise and share the game. These additional communication channels were integral to managing the impression one gave to others; they provided users with tools to orchestrate their supporting cast as seen in A.3.

Following on from A.3, this chapter offers new examples of weaving pervasive games into everyday life but it goes further than Feeding Yoshi or the other awareness systems presented previously, with the inclusion of multiple communication channels that were not designed as part of the experience. The multiple different channels used included the game website and mobile client, SMS messaging, telephone calls, and other social networking sites. While this was necessary for the players to successfully manage the impressions they gave and their play in the game from an evaluators perspective this provided a huge challenge, as the author has highlighted in [119], especially when systems are designed to support multiple plays or longer term use as advocated in Chapter 2. Therefore evaluators should try their best to capture or observe this information where possible as it gives a greater insight into how ubiquitous technology is woven into every day life.

Again we offer a summary of the lessons or guidelines drawn from this chapter:

- Support tailored presentation both explicitly and implicitly
- Enable users to account for their actions or claims made about them.
- Support multiple personae

- Digital presentations should make use of logged information from everyday life as well as explicitly created content by the user.

The remainder of the thesis will focus on drawing from the systems presented, discussing the challenges of designing for impression management and outlining considerations that must be made. The thesis will then conclude with a short discussion of future work and responses to the research questions set out in 1.5.

Chapter 8 Conclusion

This section will summarise the overall thesis, briefly discussing briefly each chapter in turn. The author will then outline the contributions made and conclude by discussing the original research questions laid out in Section 1.5.

8.1 Summary of thesis

In Chapter 2 several topics relating to the work in the thesis were outlined, in particular this chapter focused on, context, awareness and appropriation, and how they are important to impression management. The features that make up the current context and how individuals use them to construct appropriate presentations of self and how systems can use them to drive adaptation were discussed. This section also discussed many of the problems faced when presenting oneself to others and in particular looked at how self-presentation is done in social networking sites and online games. This section also reviewed infrastructure that was important to the chapters that followed it in the thesis.

Chapter 3 and Chapter 4 highlight two significant issues in impression management, hiding and revealing, and accountability. Both of these issues are intrinsically linked, often hiding information prevents one from being held to account by one's peers. Revealing information can be used to create an account for example showing oneself as a dedicated football fan or hard working team member. There are a number of issues that are explored in these chapters including retribution, 'the team', and behavioural change. Each of these topics has a significant impact on how individuals present themselves and these are discussed in these chapters and built upon in subsequent chapters.

Chapter 5 drew from Chapter 3 and Chapter 4 as well as the original cases studies in Appendix A that both these chapters were built upon. Chapter 5 presents a design framework for supporting impression management, highlighting the important areas for considerations and presenting a series of guidelines. These guidelines are designed to aid the process of creating systems aimed at impression management.

Chapter 6 presents three significant pieces of infrastructure that follow the requirements laid out by the framework presented in Chapter 5. Chapter 6 charts the evolution of these infrastructures; the first piece of infrastructure is an ad-hoc peer-to-peer infrastructure that provides mobile devices with a lightweight mechanism for sharing information. The

Domino component architecture, built upon this to provide users with the ability to adapt and change the software they were using. Finally Egor built on both of these technologies to provide individuals with an infrastructure that could tailor their presentation of self, based on the audience.

In Chapter 7, Egor, an infrastructure for tailoring digital presentations of self when the presenter is not there to dynamically react to the audience, was presented. This chapter discussed the trial of Ego, a game that made use of the Egor infrastructure to tailor online profiles based on who was viewing them. This facilitated the players in maintaining multiple personae, along with 'hidden talk' made outwith the public game setting. This section also highlighted the importance of being able to account for one's actions and when one could not do so the retribution that followed was illustrated. While Ego made use of everyday activity tracked by a mobile device, such as where one went and who one spent time with, it is hoped that in the future the choice of what to incorporate into one's own presentation will be supported by Domino, with individuals being able to choose new modules and personalised configurations (see 8.3).

8.2 Contributions

This thesis is aimed at addressing the problems associated with presenting oneself through technology, in particular ubicomp technology, and how technology itself can be used to assist this process. The author tackled the issue of presenting oneself through ubicomp technology at three levels: user experience, user experience design, and infrastructure design. This was framed by three research questions, introduced at the outset of the thesis:

RQ1: How do users of ubicomp systems appropriate recorded data from their everyday activity, making it into a resource used in expressing themselves to others in ways that are dynamically tailored to their ongoing social context and audience?

RQ2: How can ubicomp system developers design and develop systems so as to support such appropriation as a central part of a useful or enjoyable user experience?

RQ3: What software architectures best suit this type of appropriated interaction, and developers designing to support such interaction?

Each of these questions has been answered specifically focusing on the systems presented in each chapter. To summarise:

RQ1 has been addressed through the study of several systems, with detailed findings focussing on two of the most significant issues presented in Chapters 3 and 4 and an extensive literature review.

RQ2 was addressed by undertaking several different cases studies. Each cases study is discussed in depth in Appendix A and four guidelines are drawn from these:

- Support unpredictable interaction
- Support adaptation and customisation
- Support reflection and repartee
- Support tailored presentation of self.

This led to a meta-review of these systems that highlighted the significance of hiding and revealing, and accountability in impression management, which are discussed in detail in the main body of the thesis. From these more detailed findings and from within the literature review, a higher-level framework was created that designers can use when designing to support impression management. This highlighted five general guidelines that should be used when designing systems to support impression management:

- Systems should enable users to capture the information they wish to use in self-presentation
- Systems should support the tailoring of this captured information
- The creation of appropriate presentations of self, given the current context, should be facilitated.
- Systems should support reflection through feedback based on the audience's reactions to the presentation.
- Presentations should not be indefinitely and freely available unmodified to the audience.

RQ3 again has been addressed in Chapter 6, with several examples of the infrastructure in use shown in Appendix A. The Egor architecture represents a complete implementation of

the design guidelines created to support designer's design for impression management using ubicomp technology, drawn from earlier parts of the work.

These research questions have highlighted an important issue that we deal with throughout our everyday life that has been considered in ubicomp but never explicitly designed for. By being more aware of the implications of impression management and designing to support users in this endeavour a number of more traditional questions raised in ubicomp will benefit. For example, privacy and security can learn much from the nuanced and subtle ways in which individuals hide and reveal information to protect themselves from retribution from peers.

The case studies themselves have raised many interesting questions and this thesis has focused on those directly related to impression management. While this is a traditional domain of study in sociology, within ubicomp this has often been an area of reference rather than as an area explicitly to be studied and more specifically designed for. The aim of the framework constructed in this thesis is to make designing for impression management more accessible for ubicomp designers. Even simple considerations such as ambiguity, and impressions given off—particularly by systems—can provide important insight in to preventing the loss of face and subsequent embarrassment or retribution.

The peer-to-peer ad-hoc data transfer architecture; while not unique it was required so that a lightweight mechanism for opportunistic data sharing could be supported. Similar architectures were often bloated and make fast peer-to-peer ad-hoc data transfer, difficult from an implementation perspective, or are not timely enough for a mobile environment. Component architectures have also provided a significant area for research, however few make use of the mobility of individuals. By providing this in Domino components could be disseminated through groups of peers and configurations could be shared. Egor is the most unique infrastructure built and presented in this thesis. So far it is the first infrastructure to explicitly take into account impression management and provide individuals with the ability to have their presentations of self-tailored to an audience. By making use of information gathered from everyday life through a variety of sensors and the ability to add new information as required makes Egor easily extensible and adaptable based on each individual users needs.

8.3 Future Work

Although a substantial amount of work has been completed during the course of this thesis, there remain limitations that the author hopes to overcome in the future, and opportunities for further development of the infrastructure and refinement of the ideas and concepts.

This thesis has reviewed impression management in general and studied several ubicomp systems. To further develop both the framework for designers and the system architecture further study of this area will be conducted. In particular how impression management is done through different domains where technology is integral to the interactions between users. Also, as the author has advocated, longer term trials of other ubicomp systems will also provided a more comprehensive insight into how impression management is done and evolves over time. The author has been studying football supporters exploring how they conduct themselves and control the impressions they give to others. This has also led to the construction of new software that will be trailed in the near future.

This thesis has drawn from several studies of ubicomp technology and an extensive literature review of impression management. From this the author has presented a framework for designing to support impression management. While the aim of the framework is to support design for several different phases inherent in impression management, the extremely nuanced behaviour of this activity means that this framework should evolve and change over time through lessons learnt from designing such systems. In the future the author aims to make the framework available to designers so that it can be tested in different domains where impression management is an issue. This should lead to future iterations in the design of the framework to refine and expand the concepts involved in it.

The author's work on the Contextual Software project at Glasgow (EPSRC Grant EP/F035586/1) will enable several features of the software architectures presented to be further developed. This project aims to make user experience, design and evaluation in ubiquitous computing more integrated and synergistic than before. It deals with systems that fit with user context and interaction, and takes an Equator-inspired holistic view spanning technology, use and users, in which the unit of design should be social people, in their environment, plus the system. First this project aims to look at using Domino to provide support for programmers and evaluators as well as system users to support the design implementation and evaluation of ubicomp systems. Domino needs to be improved

so that the recommendation process not only generates suggestions for modules to add but also for modules that should be removed. Another area for exploration is the use of different recommendations systems to provide these suggestions. The second area is the further development of Egor. Currently the Egor framework supports presentations tailored to individuals or groups however, Ego only created presentations based on a presentation made to an individual. In the future the author would like to experiment with creating group tailored presentations [106]. This in itself introduces challenges such as how to detect which individuals make up a particular group Another aspect of the Egor framework is to include the future as something that might be considered as part of context. This will enable users to experiment with presentations of self so that they can see how others might perceive potential future interactions. Finally the Contextual project is considering combining Domino and Egor to create a more dynamic and adaptive system for supporting impression management that might be used in the Stadiums project also at Glasgow, to support football fans in capturing and tailoring presentations that they can give to others.

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Appendix A. Case Studies

Gaming offers a way of learning, relaxing, expressing emotions and exploring new ideas over a long time. This thesis, uses games to explore some of the new and challenging ideas, concepts and technologies needed for self-presentation and impression management. Computer gaming need no longer be confined to the home; instead it can be taken out and played in the street, on a bus, at a friend's, in fact anywhere we choose. Ubiquitous gaming offers an opportunity to integrate the social aspects so important to traditional gaming into our computer applications. The games presented in this thesis follow this idea. Games, unlike other technology, give users the freedom to appropriate and use the system in unforeseen ways (see 2.1.4). By doing so they stress the system in ways that are not often done. In [127] Taylor notes this very point,

> *"Through avatars, users embody themselves and make real their engagement with a virtual world. They often push back on the system – asking more of it, turning its sometimes limited palettes into something other than what was intended. Avatars, in fact, come to provide access points in the creation of identity and social life. The bodies people use in these spaces provide a means to live digitally – to fully inhabit the world. It is not simply that users exist as just "mind", but instead construct their identities through avatars."*

This statement points out how players embody themselves through games combining both their physical world and digital world, with both providing reference to one another. While using games for research can provide significant benefits it also introduces an interesting paradox. Since using games for research requires that the games themselves must adhere to a research theme or technology being explored, rather than the focus being on the game design. This is often not the optimal strategy for game design, however when using games as vehicles for research it is the research that must take precedence and not the game itself. However, while this provides a vehicle for studying particular topics, if games are not well designed then the experience will not be enjoyed by those playing and therefore may be to the detriment of those studying the system. There is therefore an interesting tension that must always be addressed when using games in this way, designing fun and engaging games that make use of the technology wishing to be studied.

The *ESP* Game [3] is an example of a game designed to produce useful by products, exploring human computation and the advantages that it can bring. The game used a simple gaming environment to label images that are presented on the Internet. The game made use of users willingness to play and have fun to perform the labour intensive job of image labelling over large corpuses of data such as the Internet. The game involved two players attempting to both guess the same word for the image they were presented with. The pairs of players were chosen at random from all those logged into the game server, this was to prevent two players conferring with one another. This game highlights the usefulness of games, however the games presented in this thesis focus predominantly on mobile multiplayer games.

Mobile games have proved to be useful at testing many different concepts and technologies. In [126] Szentgyorgyi et al., discussed the practices that surround the social use of the Nintendo DS [21]. Falk also discusses the importance of spontaneous interaction in [57]. Throughout ubicomp many different technologies have also been explored. *NodeRunner* was a game that made use of the existing wireless network infrastructure. Each team had a PDA equipped with 802.11 and a camera. Teams of players raced against time logging as many access points as they could, uploading photographic proof of each find to a central server.

The *Pirates* game [10, 57] used RF technology to determine the proximity of players to one another and specific resources. The game mapped an ocean environment on to the real world and players took the role of a ships commander travelling from island to island trading and fighting in order to gain wealth. The underlying RF infrastructure was mapped to specific game events so that when a player came close to a RF beacon representing an island, a game event was triggered. In particular, face-to-face interaction was a key part of the game, encouraging some of the social aspects of gaming, which can be lost in computer games.

Limitations or constraints are also a long established part of game play, in the form of game rules [88]. Games thus allow us to experiment with systems that use their technical limitations to forward the gaming experience, but which might seem arbitrary or frustrating in a performance-orientated application [9, 30]. In the following sections of the thesis the

[21] http://www.nintendo.com/ds

limitations of positioning and communications will be explored, and ways in which this information can be presented and used as a resource within ubiquitous gaming experiences and ongoing self-presentation.

A.1. George Square

A.1.1. Introduction

George Square is an area situated in the heart of Glasgow's city centre and is a highly popular tourist destination The square itself contains many statues and monuments of Scottish and British historical figures. The George Square system, named after this location was initially trialled in an attempt to address the many mobility problems faced in the Lighthouse [17]. George Square is a co-visiting system intended to free users from location and mobility constraints experienced during the trial of the Lighthouse system and allow them to utilise the system throughout an entire city. The system was designed to enable a tourist to move around the square and to support communication with other people who were not co-present.

The other main aims of George Square were to explore how collaborative ubicomp can work over an entire city space rather than a single confined location, and to encourage users to look beyond their own use of information and consider how their accessing the information may be perceived or utilised by other co-present or remote users A secondary aim of the system was to explore how the concept of web-logging could be implemented into an existing infrastructure Recently web-logging, or blogging, has experienced an explosion in popularity but, despite their vast number, most bloggers edit their blog using standardised and rather plain tools thus resulting in the majority of blogs having an extremely similar appearance George Square permitted the integration of ongoing logged activity into a blog-like web site that allowed a user's location and the information they viewed to be uploaded in order to generate a novel blog site.

A.1.2. System Overview

A.1.2.1. Visiting System

The George Square system supports a range of different scenarios. The main scenario was to support mixed groups of visitors, including those physically visiting the square and those exploring the square via the Internet. Physical and online visitors can be guided around a place, or an online visitor could 'piggyback' on the experiences of a physical visitor. However, a single visitor can also use the system, visiting a new place, taking

photographs and browsing web pages using the system's recommendations. The system also supports users who are all distant from the area but interacting via the Internet. The latter scenario is important since the observational studies of city visitors emphasised that the visit itself is only one part of a visitor's experience; the 'pre-visit' (where a trip might be planned) and 'post-visit' (where a trip may be reviewed and displayed to others) have an important role for both planning and sharing. The design therefore supports users in planning their visit in advance, and in reviewing their visit afterwards.

The system provided the visiting and distant users with four key collaborative resources. First, users' locations were tracked using GPS and displayed on a map, with non-mobile users able to move an equivalent avatar by clicking on a location on the map. This supports a shared sense of context in terms of location. Second, users can share photographs taken from an attached camera. Whenever a user captured a new photograph it was geo-referenced and a thumbnail was shown to all users on the map (see point 1 in Figure 8) indicating where it had been taken.Third, users' activity is recorded and compared to the history of others' past behavior, producing a focused set of recommendations of places, web pages and photographs displayed on the map in the locations where they were captured (see point 3 in Figure 8). Lastly, the system uses voice-over-IP to support talk between participants.

In use, the shared conversational resources of the system proved to be of primary importance in that photographs, web pages and current location provided visitors with topics to discuss during their shared visit. Users not only discussed and collaborated around the viewing of photographs they also shared the taking of photographs—collaboratively creating and arranging photographs of the square. Lastly, the system's use of history, through the recommendation system, worked to bring together online aspects of the visited square with the physical site.

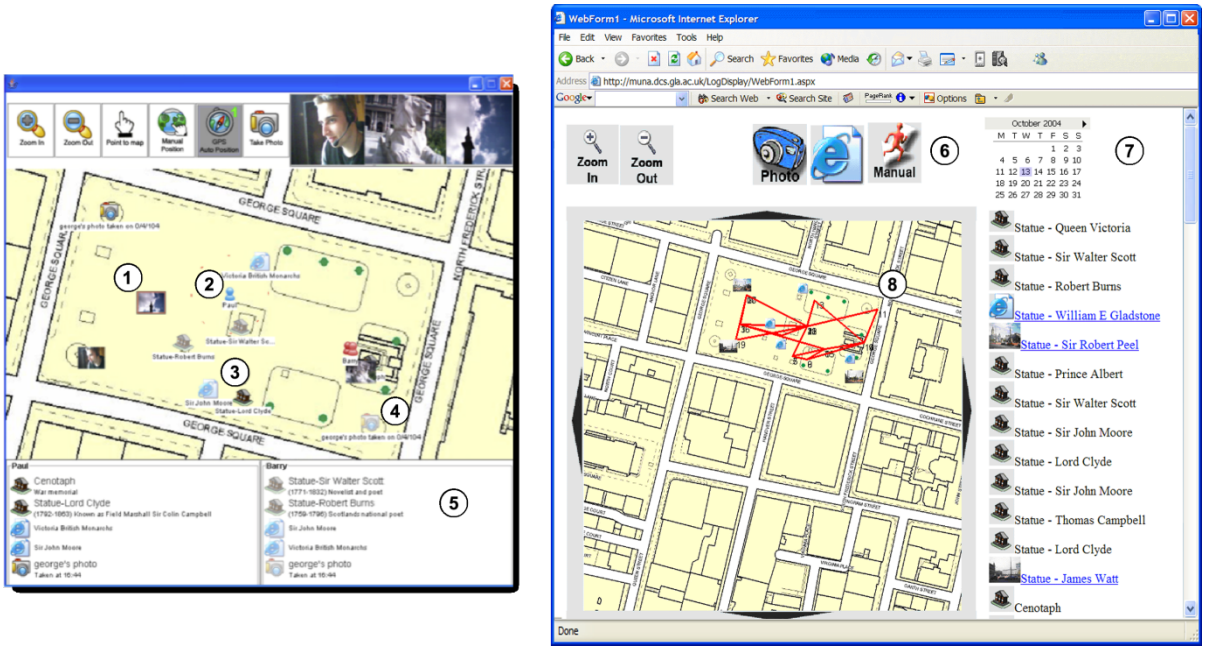

Figure 8: Left: George Square interface showing photographs (1), user's location (2), locations and webpages (3), past user's photographs (4) and recommendation list (5).

Right: George Square post-visit weblog interface showing filters allowing viewers to see particular types of information (6), dates visited (7) and special representation of a previous visit (8)

In George Square, the locations visited (manually and automatically tracked), the photographs taken, and the web pages visited were all logged to a database. The last few minutes' log entries are used to find periods of time with similar context and activity data in the logs of previous visitors. This is the first stage of the Recer [27] collaborative filtering algorithm, which was used to find attractions and web pages accessed by previous visitors in similar contexts [27]. Pictures taken by visitors in similar contexts are also recommended. These recommendations are displayed on each user's map, and in a legend below each map. In order to support sharing and discussion, other's recommendations are displayed 'ghosted' on the map (see point 5 in Figure 8). Map icons for web pages and photos can be clicked to view the related content in detail.

A.1.2.2. Recommendations

The use of past activity to build up content in the form of web pages and photographs gives the system considerable flexibility. It can be run in a new city with the minimum of reconfiguration—new content does not need to be produced in advance, since it will automatically accumulate from the use of the system. Together these features further develop the concept of collaborative leisure, in the form of a lightweight mobile system

that can be run almost anywhere with a minimum of configuration, pre–authoring and setup.

The recommendations used the path-based model of context, the Recer collaborative filtering algorithm works by matching a user's recent activity with similar past periods of activity from other users, and then draws recommendations from these periods. Recer builds up paths of activity by logging activity through a variety of sensors, to a local database stored on each device. Once several paths for different users have been built up, Recer can use them to find recommendations for future actions based on an individual's current context. In distributed mobile systems path data is transferred whenever peers are within range of one another. In George Square local databases were continuously synchronised between the remote and visiting users using a constant WiFi connection which covered the square and a near by indoor venue where the remote user was situated. Recer then examines the most recent section of a path—the 'current context'—and subsequently compares it to all of the other paths stored in the database searching for instances that occur both in the current context of the individual and in the paths of others. 'Windows' of time are built up around these common items and any other items that fall within these windows are aggregated, ranked and returned as recommendations. The flexibility of the path model allows recommendations to be gathered from any paths recorded in the system.

An important point to note about Recer's path model is that it treats all items stored in the path equally There is no hierarchical structure built into the path; it is a flat model with the same weight given to each item Thus, an entry into the path noting the user's current URL access is equally as important as an entry recording their current GPS location This flat model is a useful way of maintaining an outlook on the different types of logged media that prevents any particular type overwhelming the system and taking a dominant position in the model. The only issue to be aware of is that it may be the case that more frequently logged types of information may gain greater weight but this can be countered. The reason Recer is so flexible is due to the fact that it uses the path model which, although extremely simple to create, provides a large number of possible interpretations as well as providing the opportunity for a great number of higher level abstractions about what kind of activity is taking place in a path

A.1.2.3. EQUIP

To support the peer-to-peer data sharing necessary for the sharing of data used to generate the recommendations as well as the other logged activity George Square used a distributed tuple space called EQUIP [74]. EQUIP is a middleware that supports a peer-to-peer communication between networks of sensors and output devices via stores (or 'spaces') of records (or 'tuples'). EQUIP is used to send data both between different machines and system components. Tuple space events support sharing data between components as well as network communication, allowing the flexible combination of components. By using a peer–to–peer architecture, each component can also be used without reliance on a central server. The event–based architecture allows devices and users to leave or join at any time, with dynamic and automatic reconfiguration. Events describing user activity and sensor readings—such as GPS—are recorded by logging components, and entered into a database with PostGIS installed for spatial querying. After each visit, the individual users' databases were aggregated so that their logs were added to the shared source of recommendations for future users. It also meant that they would be stored online for use in the weblog.

A.1.2.4. Post-Visiting Weblog

The George Square weblog provided users with an automatically generated 'scrapbook' of their visit to George Square. It was designed so that users could go back and review what they did long after their visit to the square. The George Square blog was provided to visitors via an online interface, the system itself was designed to look as similar to the visitor system as possible (see Figure 8) The weblog showed the information gathered in two ways, temporally as a list and spatially on a map. This enabled visitors to view what they did, when they did it and at which point in the square. Both on the map (see point 8 in Figure 8) and in the temporally ordered list, web pages were signified with Internet explorer icons and photos were shown with thumbnails of the images. However, the path travelled was shown differently in each view. On the map the path travelled was shown by red lines indicating where visitors had walked, in the temporal list the locations travelled were shown by landmarks encountered during their movement around the square. Visitors could look back at the web pages of photographs they used as resources by clicking on the icons in the list or on the map. By clicking on the items a window opened displaying the relevant web page or photograph to the visitor. Visitors could also filter which information was displayed on the map using a range of controls situated in a bar at the top of the webpage. They could zoom in and out of particular areas on the map; they could choose to view photographs, web pages or locations individually by selecting one of the filter buttons (see point 6 in Figure 8) and finally they could look at the visits of other users by selecting which days they wished to view on a calendar control (see point 7 in Figure 8).

The weblog, like the visiting system, also supported a range of scenarios. The main task supported was for visitors to look back on their visit. However, the system could also be used as in the pre-visit experience so users could look at what others had done and plan which things may be of interest to them. The blog did not initially support tailoring of information, however several users expressed the desire to be able to 'cut out' parts of their visit. This was quickly modified so that users could remove entries either for privacy reasons or simply because he or she may anticipate a section of the visit which would not be exciting or interesting for others to view.

The George Square blog was developed before the introduction of the Google maps API and therefore required the use of custom mapping software. The mapping component used in the George Square blog was written in C#. The mapping software enabled the display of multiple marker layers used to display each of the three types of information—location, photographs and web pages. This also provided users with the ability to pan and zoom the map to provide both an overview of the visit and a detailed view of specific areas. The information displayed was drawn from the database logged to by the George Square visiting system. The weblog drew its information form a centrally stored database of users' visits and used ASP .Net to construct the users visit ready for presentation to them. The remainder of this section will concentrate on the user study of George Square.

A.1.3. User Trial

The study of the George Square system was designed to explore three topics. Firstly the trial was designed to explore the deployment of collaborative ubicomp over a large urban space. Secondly, the system was setup to, explore how, and encourage users to, look beyond their own information and consider how it might be used and perceived by others. Finally the trial was design to explore how on-going interaction can be incorporated into web-based presentations such as blogging.

The scenario used for the trial was of two friends sharing a visit to George Square, communicating via the system – one physically located in the square and the other remote. Participants were asked to freely explore the square, learning how to use the system and sharing their visit to the square. To specifically test all the aspects of our system, for the last ten minutes of the trial visitors were also given a short list of tasks to complete, such as sharing a photograph of the square, and finding out the height of the statue in the centre of the square.

Studying George Square produced several important insights. Those most relevant for impression management were, support of user-generated content and its display to others, filtering of information based on past activity, and designing for disconnection. The later of these findings focusing more on the architectures that best support impression management Later this section will discuss sociability and the support for changing roles and fluid group dynamics. Those topics most relevant to the two main themes concerning impression management (e.g hiding and revealing, accountability) are discussed in the main body of the thesis.

A.1.3.1. The Method

During these trials the participants were directly observed by the evaluators, the author sat with the indoor participant while his colleague, Barry Brown followed the outdoor participant video taping their activity for subsequent analysis. Both systems were also extensively logged. After their visit the participants were interviewed, discussing each of the four resources and how they used them. Since the system itself used EQUIP it meant that log data could be fed back through the system and replays of what the participants could see on there screen could be obtained. These were synchronised with the recorded video and audio and used for analysis.

A.1.3.2. The Users

The trial of the George Square system involved 10 pairs of friends. The duration of the trial varied between 35 to 60 minutes, with each group participating in a 10-minute post-trial debriefing. The users were recruited from the cities tourist information centre, language schools and from the University of Glasgow. There was a mix of Glasgow ‘natives’ (10) and visitors (10). Ages ranged from 19 to 35, with 13 female and 7 male participants. Each pair of users was taken to George Square, an open city square (125 meters by 90 meters) in the centre of Glasgow. This square is a focus for tourists in the city, as it has a number of statues, monuments and gardens in it, and is surrounded by several major civic buildings. One user was taken to an indoor venue on the corner of the square (the indoor visitor), and one visitor was taken out into the square itself (the outdoor visitor). The outdoor visitor was given the tablet computer as described previously, while the indoor visitor sat at a conventional laptop PC, equipped with a USB camera. While the indoor visitor did have limited visual access to the square, a frosted window and the seating arrangement meant that all but a corner of the square was obscured from view.

A.1.4. Findings

A.1.4.1.1. Support for changing roles and fluid group dynamics

Previous systems that review statically defined roles are at best problematic and at worst they can prevent tasks from being completed. In particular, the Lighthouse system, built prior to the George Square system, was very restrictive. It had a strict requirement for an exact number of users and each user had to fulfil an exact role. For example, two users who wished to use the system while visiting the Mackintosh room would be unable to do so unless a third person could be found, simply because each part of the system had been designed to look for connections to two other peers and not to begin unless they were found. In George Square unlike the Lighthouse, roles were supported in an implicit and fluid way. By providing users with the same set of tools they could then decide which subset of those tools best supported their role in the visit For example, the online visitor often looked up web pages in order to support the mobile visitors. This resulted from the difficulty inherent in trying to type in a URL using a stylus whilst moving around.

	Outdoor	Indoor
Pictures taken	214 (78%)	61 (22%)
Web pages browsed	25 (20%)	98 (80%)

Table 5: Pictures taken and webpages viewed during the George Square Trial

While the system was primarily designed to take account of the situated visitor and the remote collaborator other aspects of the tourist experience were also supported. The roles of planner and reviewer as well as visitor and remote collaborator were also catered for in the system. Therefore both the pre-visit and post-visit were facilitated by the same system also used in the actual visit itself. The importance of this was something found by Brown in his study of The Lighthouse system and its failure to provide this functionality. For example, before a visit, the system could be used to experiment with paths through the city. By using the ‘manual locate’ function to position ones avatar, one was able to experiment with various different actions and histories—viewing the recommendations for nearby attractions that would be delivered as one did so.

There were several aspects of the system that helped provide this support, firstly the user interface for co-visitors, regardless of whether they were situated in the physical space or remotely connected, was identical. Since the user trial took place with one individual out exploring the space and the other indoors but nearby the location being visited, some individuals expressed the desire to swap roles with one another. Therefore having a consistent user interface supported the users in their transition from a remote collaborator to a situated visitor and visa versa. Similarly, the post-visit blog site was designed to be as

identical as possible. Again, even through many users did not visit the blog until some time after their use of the actual system, the familiarity of the interface resulted in no users having problems utilising the functionality it provided. Secondly, there was a large amount of contextual information shared between the users. The interface itself provided users with recommendations of places to see, websites to visit, and pictures others had taken to look at. This additional context information allowed one user to see quickly what another had recently been interested in and provided an element of predictability about what they might do next (see 2.1). As a result, if a new user joined an existing group of visitors he or she could quickly understand how the visit had been progressing and smoothly integrate themselves into the visit. There were several other instances where the contextual information proved to be extremely useful, for example, one user during a trial saw that the remote visitor's icon was placed near some statues of lions in the square and offered:

> *"I'll take a picture of the stone lions for you. They're very majestic".*

Similarly, remote users, who had more time available to browse the web, were able to point out items to those physically in the square that seemed interesting based on the information they read on the Internet. One remote user pointed another visitor present in the square to an item they found interesting and requested a picture:

> *"Or see if you can get that picture of that human rights plaque that's just near you just now. There's a human rights plaque that's just near you. I've circled it, don't know if you [can see]"*

By providing this context information about others, smooth collaboration was made possible (see A.6.4.1). It is clear that this information provided individuals with a better understanding not only of the current actions of their co-visitors but also of possible future actions they may take. This not only benefited users ongoing collaboration, it also greatly reduced the time and effort a user assuming a new role must observe others before he or she can offer similar help. This was repeatedly observed in trials in which the user physically present in the square often started exploring the area before the remote user's system connected. When the new remote user connected, he or she was instantly able to see what the user in the square had already looked at and what recommendations had been made. Therefore, it was extremely common for the first action upon seeing this to offer to

help find more information on either what the user in the square had just seen or on one of the items that had been recommended, and so was likely to be viewed next.

By allowing this negotiation of roles through their implicit definition, the freedom of George Square was substantially increased and was a far better fit for a mobile community where group members are transient. This freedom from strict, static, role definition also enabled users to manage and organise dynamic group structures in which each individual moves between a variety of roles (see 7.1.4.2). The technology used also enabled this fluid group dynamic in a number of ways, such as support for disconnected groups or individuals and the ability of latecomers to 'catch up' with the visit.

If a new device joins a group of peer devices already engaged in a visit, the information about recent activity is passed to them by one of the existing peer devices in the community—through the shared tuple space provided by EQUIP. Indeed, it is possible for every action since the system began to be passed to newly arriving peers if required. Thus, even if a group of users had been using the system for some time and had already moved around the city taking photographs and receiving recommendations, upon joining a new user would immediately be delivered all this information. It also enables newly connecting visitors to integrate rapidly and smoothly with a community of users, to learn the context of the community and to behave appropriately within that community. However, while this is appropriate for catching up on short periods of use that one has missed if the period of time missed is significantly long this would create a snowstorm of replayed events while the system catches up. Therefore it is important to apply this technique in the appropriate way.

The ability to catch up quickly by examining events missed while a device was not a member of a community, either because it had never joined or because it had temporarily left, has the additional advantage of supporting mobile devices which may face the generally less reliable network infrastructure of a mobile environment. For example, if a mobile device experiences disconnection from a peer community due to network problems, or simply because the owner turns it off to conserve battery power, this ability can ensure smooth reintegration when a connection is again available without any adverse affects. Since any information that had passed in the interim would be delivered as soon as the machine rejoined the system. In the George Square trials, this was experienced in virtually every individual trial. The northeast edge of the square was rather distant from both the

remote visitor's device and the infrastructure access points that had been set up in the area. Thus, when a user entered this area of the square, neither a direct connection to a remote visitor's device or a connection through the infrastructure access point was available. However, their system continued to operate, although it did not provide live updates from co-visitors. Once it re-entered the region where coverage was available, the first peer it encountered would automatically update it on the events and information it had missed. Similarly, the device would do the same for the actions the user had performed whilst outside network coverage, propagating his or her actions to others.

This type of configuration provides many advantages, most importantly is the dynamicity allowed to peer communities. The ability for individuals to break off from the main peer community and work on their own for a period of time—rejoining in their own time without losing any information or functionality, is important in many everyday tasks. Furthermore, the system actively supported individual users working by theirself and recording information for later sharing with the community. Whilst users were disconnected new recommendations on locations to visit would still be generated and delivered, and any locations or websites the user visited or photographs he or she captured would be stored and shared to peers if the isolated device became reconnected in the future. This behaviour is vital in a mobile community, as there are often large periods of time when devices are isolated from either infrastructure or a peer community. The George Square trials revealed that in virtually every trial at least one device operated in an isolated fashion for some period of time. As periods of isolation are normal for mobile systems it is important that functionality continues in these situations and ongoing information is recorded, in order that the community may benefit from the data collected.

A.1.4.1.2. Support sociability

The George Square system provided several communication resources, the most valuable of which was the audio channel. Visitors used this to discuss what they had been doing, what they were doing and what they were about to do. The objective of the discussions was very diverse, including functional and playful, with both focusing around common conversational resources found during the visit. These resources included statues, surrounding buildings, wildlife and others that shared the square with the visitors, such as commuters. Much of the visitors conversations however, centred on the statues and trying to place them in context historically and understanding more about the individuals, for example:

Visitor: On the statue to James Oswald it says given by a few good friends
Remote: (Browsing a web page) Eh (.) I think he's a MP it says he was one of the first Glasgow MPs. He was elected in 1841 and the statue was erected in Charing Cross and then moved to George Square
Visitor: No way
Remote: So they obviously thought he was good enough

As previously mentioned, the more factual 'high cultural' aspects of the square were combined with the more playful. Here the tourists move quickly from talking about statues in the square, to joking about the pigeons that inhabit the square:

Visitor: I'll take some more. I'll take one of a horse
Remote: No I don't want to see that I've got one of those. Take one of a pigeon
Visitor: Pigeon? What about will I take one of Barry
Remote: With a pigeon
Visitor: K wants to see a picture of you with a pigeon
Remote: Feeding a pigeon
Visitor: What? You can't feed the GPS system to a pigeon (laughs)

These types of conversations are notable for their playful, non-goal focused nature and are seen throughout several of the chapters in the thesis such as Chapters 5, 6 and 7. Earlier ethnographic work conducted by Barry Brown emphasized that tourism is as much about shared enjoyable experiences as it is about the specific place being visited [16].

The sociologist Simmel (1949) [121]argued for the importance of the shared experience of enjoyable conversation—an experience he called 'sociability', where the purpose is not external to that experience but rather is the experience itself. As he put it, when we engage in the company of others we engage for the company itself [31]. This is also highlighted in [45] by Ducheneaut and is discussed in Section 2.2.4. For pleasurable and enjoyable city visiting, many of these aspects of life come to the fore, for example the enjoyment of shared experiences and conversation with family and friends, in a setting that supports these experiences and this conversation. Simmel also stresses the importance of common norms shared by both parties in these forms of conversational exchange. One of the forms of conversational interaction explicitly discussed by Simmel is the discovery of common convictions and its importance in establishing relations between individuals.

While some technologies can get in the way of normal social practices, George Square was reasonably successful in supporting the ongoing social interaction and in particular take around shared artifacts. Shared photographs, recommendations and web pages acted as 'local resources' [115] for conversation, in that objects that were seen in common could be used as topics to talk about. We should not be surprised that people share information in a playful way but we should recognize that people draw from their everyday lives to enhance and augment their conversations and experience. For example, in the following extract the visitor presents information about a previous event that they attended and expresses their individual opinion of those that attended the event with them, thus expressing a very personal view and revealing aspects of themselves to the person they are sharing the visit with.

> *Visitor:* *There's a shopping centre nearby there I went to a Scottish party with Scottish dancing… It was really, really nice and the people either they were drunk or they were crazy. I think it was half and half*
> *Remote:* *Can you take a picture[of the shopping centre]?*

This mixture of functional and playful discussion in George Square shows that conversational resources can be used for many purposes. In particular their use in discovering common convictions between individuals, this is important in creating and maintaining relationships with others. While this notion of common convictions is useful it is important to note that while it is possible, as an external observer, to state that common convictions exist there will always be occasions where this is not the case. Therefore here the author is using Simmel's notion of 'common convictions' to describe interaction between people that they conform to or agree with. Often these common convictions are expressed though stories of past experiences filtered depending on whom the information is being given. George Square explicitly used recordings of visitors past experiences to provide recommendations of things to do and see, therefore providing new conversational resources that users could communicate around.

The following section will now discuss these issues along with those discussed in Chapter 3.The discussion will focus on impression management and draw out general guidelines to be used when designing for impression management.

A.1.5. Discussion

This Section has highlighted three main themes, shared conversational resources, pre-authored content, and disconnection. In George Square shared conversational resources resulted in the development of working practices between the users with those on the Internet more inclined to look up web pages with those situated in the square taking photos. This division of labour was afforded by the flexibility of the system. It also meant that fluid group dynamics and in particular the swapping of roles was not only possible but also relatively straightforward for users to do. This flexibility is imperative if one wishes to support impression management. Without such flexibility individuals are not provided with the necessary ability to adapt and change the impression they give to others. This means that appropriate impressions will not be given when the situation changes. Hiding and reveal is also imperative in supporting this flexible transition between roles and is discussed in Chapter 3.

Dynamic roles and the ability to adapt ones own behaviour can only be made possible if users have a shared understanding. It enables them to notice that a shift of presentation is required and also enables them to build up their own, often implicit, patterns of working, as shown by the tasks that the two different roles afforded. This section has shown how individuals oriented their discussion to the situation incorporating their use of the technology into their ongoing conversation. While this is not entirely new George Square shows how playful banter and functional utterances are interwoven into the experience, as well as providing opportunities for individuals to share significant happenings, from past visits or general life, that may be of interest to their co-visitors. Again this highlights how opportunities in which to reveal aspects of one's self to others can present themselves and taken advantage of.

User-generated content was valuable in George Square providing a resource from which recommendations could be drawn from and given to subsequent visitors. Previous system development that required large amounts of pre-authored content had proved restrictive in the deployment of the technology, as was the case with The Lighthouse. By utilising the user generated context the flexibility of the system was greatly increase since explicit authoring of content would not be required for each new tourist destination the system was to be deployed. Recording this user-generated content also meant that this information could be made available post-visit. This gave the users time to review and reflect on where they had gone and what they had done. Such reflection is imperative in impression management and is discussed more in Section A.5.

Technically there are many lessons to be learned from George Square. The support for disconnection through EQUIP meant that visitors could move in and out of areas where they could not connect to the Internet. GPS was another problematic technology, however, unlike with the WiFi connection users found their own way around this problem, appropriating the point facility to correctly state their position. While solutions to these problems were found—both technical and social solutions—it raised the issue of 'seams' in technology (see A.2.2). Seams and seamfulness were the two key influences in the design and implementation of Treasure, where the aim was to use these problematic aspects of technology as advantages or resources for design.

A.1.6. Conclusion

This section has presented George Square a tourist system designed to enable a tourist to move around the square and to support communication with others who are not co-present. The system was also designed to investigate how collaborative uibcomp can work over an entire city space rather than a single confined location and to encourage users to look beyond their own use of information and consider how their accessing the information may be perceived or utilised by other co-present or remote users A final aim of the system was to explore how the concept of web-logging could be implemented into an existing infrastructure.

To support distributed visitors a shared understanding and communication resources are imperative. These are often then used in several different ways: to banter and have fun, to co-ordinate activity, and to bring in aspects of oneself and one's own life into the ongoing shared experience. This sociability helps users build up a shared working practice enabling implicit roles or be defined based on the context each user finds theirself in. This should also be supported by the system, for example George Square did not have explicitly defined roles and did not restrict any of the users and therefore they could dynamically change who fulfilled each role.

This dynamicity was further supported by, designing for disconnection—increasing the mobility of users and enabling individuals to work on their own, and through avoiding pre-authored content—restricting the reach of the system. First lets consider designing for disconnection. In relation to the main aim of this study this enabled George Square to work over a larger urban location while also providing users to design work practices that best suit them and the group in which they are visiting with. This is supported since individuals

or sub-groups can go away gather information disconnected from the rest of the group but when they come back they care able to smoothly integrate themselves back into working with the larger group. Secondly, avoiding pre-authored content also increases the scope in which George Square can be deployed without the requirement of any additional work from the developers.

All of these issues have an impact for impression management too, by supporting the implicit recording of information and its display to others provides individuals with the opportunity to create digital presentations without the additional cost of explicitly capturing and uploading information. However, as the users expressed having the ability to tailor this information, particularly if it is being used to present oneself to others, is extremely important.

To summarize three guidelines can be drawn from this work:

- Support tailoring of recorded information.
- Enable users to reflect on their experience using recorded data.
- Design for disconnection.

A.2. Treasure

A.2.1. Introduction

Treasure is a mobile game designed so that players move in and out of areas of wireless network coverage, taking advantage not only of the connectivity within a wireless 'hotspot' but of the lack of connectivity outside it. Treasure was initially developed to address the connection and positioning problems face in George Square. Treasure is a seamful game intended to take advantage of otherwise problematic technological constraints such as network connectivity. The system was designed to use network coverage as a resource for a game requiring players to move in and out of network coverage in order to score points.

The other objectives of Treasure were, to explore further how ubicomp technologies can work over a large urban space, and to encourage individuals to reflect on their experiences to gain a better understanding of the game and in particular the underlying wireless

network infrastructure it used. The main objective of the game is to collect virtual 'coins' from outside the wireless network, and then run back into network range to 'upload' the coins and gain points. The players must take advantage of where coins and players are as well as 'hotspots' of network coverage and the 'cold spots' out beyond them. This coupled with regular obstacles that make up any urban space make Treasure both challenging and fun.

A.2.2. Seamful design

Ubiquitous computing is becoming increasingly pervasive, involving combinations of mobile computing and wireless communication technologies. When designing such systems, implicit but unreliable assumptions are often made, e.g. that infrastructure such as high-bandwidth communications and accurate positioning will be ubiquitously available over the entire area that an application is deployed in. Future technical developments in wireless communication technologies and positioning systems may increase the coverage of such technologies, however it must be expect that there will always be places where such infrastructure resources will be erratic, limited or non-existent. Certainly, in the near future, perfectly seamless positioning and communications seems unlikely, either due to lack of hardware, infrastructure security measures to limit access or environmental issues.

In Mark Weiser's invited talks at both UIST94 [134] and USENIX95 [136] he introduced us to the concepts of seams, seamfulness and seamlessness. Weiser describes seamlessness as a misleading or misguided concept, tantamount to "making everything the same," reducing everything to a "lowest common denominator". He advocates instead the design of seamful systems (with "beautiful seams"), which embrace these differences. Chalmers, et al. [26] further assert that when such seams show themselves, as they inevitably will, users appropriate them for their own purposes. Chalmers et al. cite an example of mobile phone users who become aware and exploit practical knowledge of the underlying mobile phone infrastructure, to use poor signal strength, or pretend that they have a poor signal, to prematurely cut short calls if they do not want to converse with the people phoning.

In technology a seam for one person may not be a seam for another, since users often have different levels of expertise with the technology at their disposal. So the point at which an individual's interaction with a system breaks down can be different for each user. Revealing the underlying infrastructure to a user in a useful way to allow them to interpret and react to any breaks in communication is one of the key considerations in *seamful design* Similarly to Wieser, Benford supported by Chalmers and MacColl [25] suggest

that, rather than fighting the uncertainty or ambiguity, we should make a deliberate choice to present them and enable users to use the seams to their advantage. Supporting opportunistic behaviour that exploits seams in this way ties seamful design intimately to the phenomenon of appropriation.

A.2.3. System Overview

Treasure was designed to support two different game scenarios. The main scenario was to support teams of players playing against one another. In this scenario players could collaboratively upload 'coins' increasing the value of each coin uploaded, and build up a shared map of network coverage. The second scenario did not support teams, instead enabling the players to play individually against one another.

To pick up a coin, a player must walk or run to the physical location of the coin as indicated on the map, so that his or her GPS–tracked location is close to the coin's location, and then press the Pickup button. For the player to gain points for this coin he must then walk or run to an area of sufficiently high network signal strength and click Upload so as to send the coins he or she has collected to the game server. The chances of a successful coin upload increase the deeper a player is inside wireless network coverage. This was shown overlaid on the main map, which also supported panning and zooming and displayed lots of information including, the player's location, the location of coins, and the location of others (see Figure 9 left).

While the main objective of Treasure was to collect virtual 'coins' from outside the wireless network and 'upload' them in exchange for points. Two other game features where made available for players, pick pocket and shield. The pick pocket was a key competitive resource enabling players to steal the coins of their opponents, however the shield could be used to protect against this.

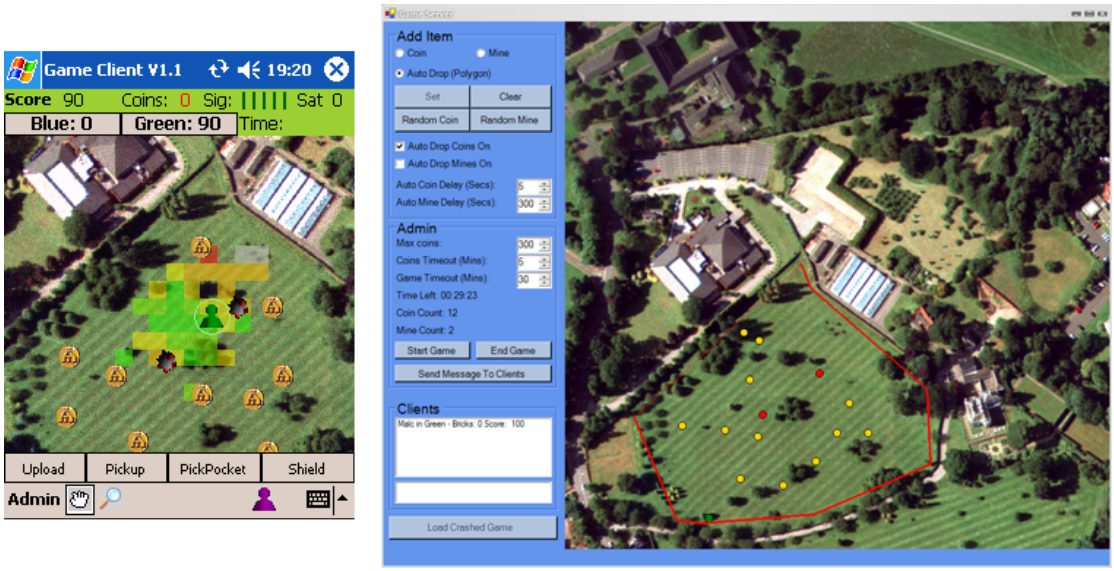

Figure 9: Left: Treasure mobile client. Right: Treasure server controls.

A.2.3.1. Design for disconnection

To make use of the seams in a wireless network an appropriate networking system that could handle disconnection and reconnection, and would also work in areas of patchy signal strength was needed. The system required each client to connect to the same network and reconnect if they left an area of coverage and came back.

The standard Pocket PC wireless driver proved problematic in this case, for a number of different reasons. Firstly, the built in driver continually requests the operating system to ask the user about any network connection decisions that need to be made. For example, users are continually being notified of new networks through a GUI pop-up stating “New Network Found” that they must choose whether to connect to or not. This is not only annoying for users but also requires users to have knowledge of various connection issues such as IP addresses and wireless security. Furthermore, as there is no automatic connection to networks, there can be substantial periods when the device simply remains disconnected from all networks whilst it waits on user input.

To resolve these problems and support the movement of players in and out of areas of network coverage a custom wireless driver had to be created that enabled us to ‘lock on’ to a particular network SSID and only ever allow the mobile client to reconnect to that specific SSID even if their were others available. In Treasure static IP addresses were used, therefore removing any time needed for requesting an IP address. This allowed data connections to be established very quickly when clients returned to the network, and increased the chance of a successful connection in areas of weak coverage.

Also the standard PPC/WM wireless driver cannot easily be controlled programmatically, meaning that not only could the previously mentioned problems not be overcome, other strategies for power saving or ad hoc peer-to-peer networking which are discussed in Chapter 6 could not have been supported. A full description of the infrastructure used to lock onto a network is discussed in Chapter 6. This highlights not only the infrastructure created for treasure but also its evolution throughout the development of the systems presented in this thesis and the need for such infrastructure to support impression management.

A.2.4. User Trial

The study of Treasure was designed to explore seamful design and how problems such as lack of network coverage can be used as resources for design. Secondly the study aimed to further explore ubicomp technology in the 'wild', studying how individuals interact and co-ordinate their activity. While the trial was not explicitly setup to look at impression management there are several themes that will be presented that directly relate to this topic drawn out from the data gathered. These themes include embodied interaction, reflection, and appropriation.

The games ran on the University campus on a fairly large lawn, its surrounding streets, and in part of an adjacent car park. This was a good game arena, in that there were large open spaces, trees to hide behind, and relatively little road traffic. The area was about 7000 square metres (64000 square feet). Roughly half of the area had good wireless network coverage. However, since weather has a significant effect on the strength and reach of 802.11, coverage varied from game-to-game, therefore it is difficult to illustrate a map of average coverage. GPS worked well out on the open area of the lawn, but it was difficult to get accurate readings close to the buildings, adjacent to the lawn, where the 802.11 access points were situated.

Treasure was explicitly deigned to combine physical and digital information to inform users about potential weaknesses in the underlying technology and take advantage of them. The most important theme with regard to impression management initially highlighted in treasure was reflection and how it was supported through multiple plays and the revealing of the underlying infrastructure and the subsequent understanding that was built up. Reflection is extensively discussed in Chapter 3 and Chapter 4 drawing from other several

of the other experiences presented in the thesis. This section will discuss some of the more general findings from Treasure.

A.2.4.1. The Method

Before first-time participants played, they were given a thorough introduction to the game, in a conference room, together with their opponents. One researcher explained the game using a paper prototype of the PDA display for about ten minutes, and then a second researcher entered with the four PDAs. The participants were then given the PDAs, and simple manoeuvres were demonstrated, such as panning and zooming the map, then the players copied these same maneuvers. They were also informed that they would be observed and recorded as they played. When the participants were confident with the game, they were taken out into the game arena. Before playing each game, the players were allowed to walk around and pick up coins in a 'pre-game', during which they were able to exercise the game operations such as uploading coins, hitting mines, pick pocketing and using the shield. Players arriving for their second or third games began out on the lawn with a reminder of the game's basics. When the players understood the scope of the game, the game began and ran for approximately 15 minutes with the winning team receiving a small prize.

During the trials themselves the systems were extensively logged, including the mobile clients and the server. Throughout each game there were also two evaluators who moved around the game arena capturing the play for subsequent analysis. Finally after each game the players were interview in pairs with each interview being recorded for analysis. With this vast area of data analysis would have been difficult however, a system called Replayer [129], was used. Replayer is a data visualisation and analysis tool for ubicomp technology and was initially conceived by Paul Tennant for the analysis of Treasure but has subsequently been built upon to study other ubicomp experiences. Replayer simplified the synchronisation of logs and the video and its visualisation components were used to gather statistical information.

A.2.4.2. The Players

The participants were recruited in pairs, and in total there were nine teams of two. The games were set up so no teams played against each other twice. Nine games were played all together, with four teams playing one game, one team playing two and four teams playing three games. The time between games varied between 1 and 3 days giving the players time to discuss the game before their next play. All participants were all

compensated equally for their time with £5 for each game. The participants were all between the age of 17 and 33 with an average age of 23.5. The sex of the players recruited was mixed. Most were students, from a wide variety of disciplines, including three computer science students. All participants used computers daily.

A.2.5. Findings

A.2.5.1. Competition and Collaboration

The competitive aspects of the game were easily observed. There were several different instances that showed the competitive nature of the players. There were several different types of play that players used competitively namely, racing, stalking, and chasing. Racing was the simplest form of competitive play. When racing, players would run to an area where there were a group of coins trying to gather them before the opposing team. A more sophisticated strategy was stalking. Stalking was an approach directly focused on another player. The players employing this strategy would 'stalk' their 'prey' hiding behind obstacles and using areas with no wireless coverage as cover. This enabled them to sneak up and ambush players within the network and steal their coins using the pickpocket ability (see Figure 10). The final strategy chasing was not as covert as stalking instead players would choose to run after their opponent in an attempt to steal their coins. This was often met with players running away trying to preserve any coins they had collected.

Figure 10: Pickpocketing in action.

The embodied interaction of Treasure also made the relationships players had with others easily observable, team mates would shadow one another and competitors would chase and race one another. The team aspect of the game made cooperation very important and it played out in several interesting ways. For example, a regular tactic, especially for the first-time players, was a collaborative search for network. Often team members would meet up to do a collaborative upload, but if one or both were outside the network they would walk side by side, staring down at their PDAs to be sure of when they had adequate connectivity to upload. While this type of behavior is common with people who are together, what made this particularly interesting was how players would walk side-by-side

but separated by an unusually large distance (2-6 meters). However, irrespective of their apparent lack of communication (verbal) and unusually distant proximity to one another their shadowing of one another's actions was significant enough to tell that they were together. These physical interactions highlight the importance of embodiment in displaying relationships and subsequently managing ones own presentation of self. Often this embodiment is lost in digital presentations of self however, by incorporating recorded information from our embodied interaction within the world then digital presentations of self can be enriched with a vast array of information.

A.2.5.2. Traversing the physical and digital

Treasure backs up the ideas of Taylor [127] and Chalmers [24] expressed in the literature review (see 2.2.1).The connection between the physical and the digital in Treasure is explicit since play involves, like many ubicomp systems, both an urban area and a digital map of that area. The familiarity of the urban setting and the game genre made it easy for the players to incorporate their everyday experiences with their game play. For example, players would cross the road, eyes fixed on the PDA, and yet they were still aware of the traffic, stopping when cars were coming and waiting without ever looking up. They were extremely successful when navigating their way through crowds of people, rarely bumping into them and also crossing the road while still being aware of the traffic (see Figure 11). Our everyday life and experience is used and incorporated into any game one plays. However unlike online games the very structure of Treasure enables face-to-face interaction providing players with a means to augment their play with complex communication techniques such as physical gesturing that can be difficult to recreate in an online game.

Figure 11**: Crossing the road.**

The physical nature of Treasure resulted in several of the game actions acquiring their own particular 'moves'. A prime example of this was how picking up coins became a noticeable activity due to technological limitations This game–specific movement was characterized by a sharp 180° turn, which was observed approximately four times per game. For example, a player would walk along, staring down at the PDA and then suddenly, without

looking up, turn 180° and walk in the opposite direction as if nothing had happened. When asked why they did this, they reported that the reason for this was often a reaction to the player's icon passing over a coin without the player managing to pick it up. The player therefore turned around to pass over it again and pick it up. The reason for this lag was due to the GPS, therefore, the movement of a player's icon on the PDA could be delayed by several seconds—resulting in problems picking up coins. Most of the players realised this over the course of their games. There were several other game specific moves such as the how players walked together when collaboratively searching for network connectivity as described above and the 'spy look' which players would do frequently to over come the limitations of the centralized architecture. The 'spy look' will be discussed in the following section.

A.2.5.2.1. Making use of the physical environment to overcome system limitations

The physicality of the game and the awareness it provided users enabled them to overcome system constraints such as the server not updating other players' positions when outside of the network. As has been mentioned the 'spy look' was one such game specific move that enabled this. Since players' eyes were locked to their PDAs for most of the game, and with the limited visibility beyond the open lawn, players mostly judged others' position via the map on the PDA. However, as the games progressed players became more experienced, noticing that often the position being reported was not accurate. This could have been down to a number of factors. Firstly, the person may not have been in an area of coverage recently and therefore not uploaded their position. Secondly, the observer may not have been in an area of coverage and therefore not received any position updates. Finally, the GPS position being reported may have been incorrect. To overcome this players would stand still for a couple of seconds, look up and then around as if to see who (if anyone) was nearby, then look down and continue walking. The movement was a scanning of the environment, trying to match the information on the screen to the actual positions of the other players. Players were aware that an opposing team member could sneak up on them, without being visible on the screen, and so they would check for this.

A.2.5.3. Adapting Behaviour

In impression management adapting ones own behaviour is critical to providing an appropriate performance in any given context. The importance of being able to adapt one's own behaviour has been discussed in Section 2.3. In games, changing strategies and ways of interacting is also common (see 2.2). This section will look at how people adapted their play in Treasure and what resources they used to do so.

How and when do people adapt or change their play in Treasure?

The historical view of context discussed in [22] and used when supporting the users of George Square is extremely important to the ongoing interaction in Treasure. Although unlike George Square this was not explicitly supported by the game itself. Instead, it was the social interaction that went on around the use of the heterogeneous mix of media, tools and artifacts that influenced users understanding and adaptation. This sharing of past experiences was extremely apparent in Treasure especially during first-time plays where players (in the same team) would share what they knew in order to understand and learn to play the game. In subsequent games this sharing fed into the development of new strategies and game behaviors. First the author will look at how risk featured in Treasure and what it meant for players.

When first–time players played against second– or third–time players, the more experienced team generally won. As players became more experienced, they also became more excited, engaged and competitive in the game and tried their upmost to win, combining complex strategies to outwit their opponents [47]. There were also a number of more subtle changes in game play. As players influenced and interacted with each other, they changed how they used individual game features and how they related those features to each other. Perhaps the most marked trend was that players chose to pick pocket much more in later games. One more experienced team was observed pick pocketing another very heavily, the latter team responded by using the pickpocket more during subsequent plays. This type of encounter was common throughout the trials and as pick pocketing increased, players used shields more and made fewer collaborative uploads. This reduction in the number of collaborative uploads seemed to conflict with the desire to win since uploading with a team mate acted as a points multiplier. However, they reported that during play they became more aware of the risks of having coins stolen and therefore they would split up to collect coins and upload them independently reducing the risk of them having both sets of coins stolen at the same time.

By focusing on individual teams and players, more detailed examples of how play changed over time can be seen. Team B was the only team to win three games, although they never played against a team with more experience than them. In their first game, Team B efficiently used collaborative uploads, succeeding three times, but then their play began to change and this evolution was driven by their opponents increased mastery of the game. In particular their understanding of when to use pick pockets so that they would successfully

steal lots of coins. For example, Team B's opponents in their second game pick pocketed them three times however, on all of these occasions the players in Team B were able to pick pocket the coins back. In their final game they were pick pocketed eleven times, this meant that the players of Team B did not feel it was worth the risk attempting to collaboratively upload even although it meant they would gain more points. One of the members of this team commented that their last game had been a 'button-bashing game', which was confirmed by the log data and further comments that echoed the character of this game:

> *"[My team mate] just lost all of her [coins] [...] and I stole them back from [the thief] who had taken it from [my team mate]..."*

The team mate interrupted:

> *"We were standing besides each other, trying to upload together and then somebody pick pocketed me and then [my team mate] pick pocketed them back".*

Pick pocketing became a highly complex tactic with many strategies employed to overcome potential counter attacks. One of the more energetic approaches observed on several occasions in the early games consisted of players sneaking up on their opponents, pick pocketing them and them running away. The aim of this was to stop opponents stealing the coins back, as experienced above by the members of Team B. Although shields were widely used, the thieves either did not have them charged or thought it more efficient to run. Other approaches included ambushing, this tactic was often employed by stalkers where the pick pocket would hide behind obstacles found in the street, steal the coins of others and sneak off before the 'mark' noticed they had lost all of their coins. Although it is hard to state why people employed this tactic there are several reasons that it may have been, it might have been simply so that the coins did not get stolen back immediately. It may also have been the result of not wishing to be seen stealing and therefore making oneself a future target for revenge.

Through these embodied exchanges interaction within the game, supported by the reflective discussion in between each play, players shaped each other's interpretation of the game space and the technology in a historical and intersubjective way. These discussions let players mold their tactics and strategies for subsequent games. It was often the case that

the strategy of the most successful player would be adopted for subsequent games, adapting as the game itself played out. The importance of shared experience is extremely prevalent here. Indeed it fits with the observations made by Health & Luff [80]. With this shared experience and understanding teams were able to adapt and refine their tactics and improve their performance in subsequent games.

A.2.5.3.1. Novice to Expert: Discussion and Multiple Plays

The games were popular and, after playing, all the participants said that it had been a fun experience. As the author has shown, in successive games teams became more competent with the basic game mechanics. They became familiar with every game feature, including the seamful features such as the map, by experimenting with the system and sharing and reflecting on their experiences through discussions with others. Through multiple plays, the relationships between actions and outcomes were both discernible and integrated into the larger context of the game. For example, one player said after the first game that she did not like the game very much, because it was difficult to find out where the signal was and where she was on the map. After the last game, however, she was asked which one of the three games she had enjoyed the most and replied:

> *"This one [...] because you are more aware of all the things that are going on. You feel more in control of, like, what you are doing rather than just randomly pressing buttons".*

Providing players with time between games to reflect and discuss their experience greatly supported their understanding of the technological features of the game. It also enabled them to build up their experience of the game, creating expectations of how others might play and ways in which to counter this play. This highlights the importance of multiple game plays and or system uses that span a significant amount of time. By doing this players are able to better understand the game and use it in new, more creative ways

A.2.5.3.2. Appropriation

System mastering or in this case game mastering is extremely important to expression of 'true character' as discussed in Section 2.2. It is through the mastering of technology that one is able to appropriate it to support ones own ends, which are often unforeseen and therefore not supported by designers. Revealing aspects of any underlying technology and rule system to the user is an extremely important technique when supporting the mastering of any technology and in particular, games. By exposing the underlying infrastructure that Treasure required to run, players were able to build up an understanding of several complex issues while never explicitly being told about them. For example they were able

to see how network coverage changed over time based on a multitude of factors such as weather or traffic levels. It is this nuanced behaviour of a system that can prove problematic when trying to present oneself in a particular way or alternatively maybe used to one's advantage such as cutting short a call and blaming it on poor signal strength.

One extremely interesting use of this shared understanding in Treasure was how people used it not only to help their game play and the game play of their team but how they used the shared knowledge against the other players. This was done through bluffing and is also seen in Chapter 7. The physicality afforded by the game and the environment in which it was played enabled other users to use the notion of pickpocket without having the ability to pick pocket. One player in particular noted that he had stood on a mine and therefore was locked out of the game for 30 seconds. He saw a player engaged in a recognisable game 'move', walking around in a regimented manor and felt they were in an area with lots of coins and they were gathering them. So he decided to chase them pretending that he was going to pick pocket them despite the fact he could not do anything—being locked out of the game. The result of the encounter was that he successfully chased the other player away from a fruitful area of coins thus preventing them from getting further ahead while he could not gather any points. At first this seemed like a rare event however, after further analysis combining video and system logs, this type of activity was shown to be common and other strategies employed became apparent.

A.2.5.3.3. Multiple Strategies

Similarly to George Square there were no particular constraints put on the roles players could choose. However, unlike George Square, the distinction between possible roles or modes of use was not as clear. The way individual players conducted themselves was heavily reliant on how their team mates and the opposition were playing. This led to two main strategies being employed by the players. These strategies related to how players collected and uploaded coins, often in reaction to the opposition's use of the pick pocketing feature. Players were generally classified as either *hunters* or *gatherers,* and hunting seemed to work better than gathering.

Hunters were the players who boldly picked up as many of the coins as they could, often from a wide area, before finding a network connection to upload. They uploaded less frequently and more carefully during the game, making sure that they were inside network coverage and had their shields on before attempting to upload—so they would not be pick pocketed. There were six individuals, identified in the trial as using this strategy in one or

more of the games they played. The pattern of play for a hunter meant that they would go 'hunting' for coins, taking chances in order to build up a number of coins for a collaborative upload with their team mate. This behavior was characterized by the number of attempted uploads during a game—20 or less, and with the subsequent rate of success of these attempts—over 50 percent. Hunters were very successful throughout the games, often uploading many coins every time they uploaded. In their second game, the Hunters average score was 455 while the average over all second games was 325. In their third game, the Hunters average score was 480 while the average over all third games was 367. One noteworthy thing is that the hunters did not necessarily occur in the same team: only in one team were both players identified as hunters.

Gatherers, in contrast, uploaded their coins as they picked them up, unless they had to leave the network to pick them up—and they normally did not stray to far from where there was network coverage to do this. This was very much a beginner's strategy, but several players persisted with it throughout their games. Some players, shifted from gathering in the beginning of the game to hunting and collaborative uploads as play progressed and competition increased. Gatherers reported that they were very worried about getting pick pocketed upon returning to the network, and therefore they hit the *Upload* button much more frequently than the hunters. Four players were identified as using this strategy in at least one of their games.

The use of these different strategies highlights again how important it is to provide flexibility in the system to support different roles in the case of George Square or strategies, as was the case in Treasure In both it can be seen how users moved fluidly between the roles they fulfilled and strategies they employed to support their experience regardless of the setting. This is just one example of the way that the experience of a game is not only about optimizing progress towards a goal. It is also about weighing system features against each other, as well as shaping and reacting to the emergent behaviour of opponents and team mates. Although a feature may initially appear useful, such as the collaborative upload, that feature may be perceived and used differently as experience grows and social interaction continues.

A.2.6. Discussion

Several themes have been highlighted in this section; design for disconnection, competition and collaboration, traversing the physical and digital, and adaptation. In Treasure the 'seams' in wireless network coverage were used as a resource for game

design. This resulted in technology being developed that was designed for disconnection in that it had to enable users to take advantage of the patchy network coverage and use the system when no coverage available. Revealing the underlying infrastructure also presented players with a visible representation of what is often invisible, enabling them to build up an understanding of where wireless coverage might be found and how it fluctuates over time and space.

The competitive nature of most games drove players to develop different strategies over the course of their three games. Two of these strategies have been discussed, hunting and gathering. The setting for the game resulted in these strategies being noticeable through bodily orientations. Therefore the impressions the players gave off through these actions were of hunters or gathers. While it has long been recognised that bodily orientation is important when trying to covey a particular impression of oneself, this is backed up and seen readily in Treasure. Often these impressions were given off rather than crafted and given to an audience, however in subsequent sections crafting of one's activity based on the setting will be shown.

In Treasure the game was designed so that digital information could be used to complement the physical environment that the game was set. This again shows how digital information cannot be considered as independent from the physical world and instead should be through as complementary to one another. For example, even when the players encountered problems or 'seams' in the technology, such as not receiving updates from other players, they were able to find a good vantage point and look around for any would be pick pockets.

Adapting and improvising one's play to overcome technical difficulties was common in Treasure. These are also extremely important to impression management and in particular self-presentation. Being able to adapt one's own performance to the giving setting, and improvising in unfamiliar settings, are key to presenting oneself appropriately. In Treasure adaptation was supported through multiple plays between which players were able to reflect and discuss the game with their team mate.

A.2.7. Conclusion

This section has presented Treasure a multi-player mobile game, designed to take advantage of the seams in wireless networking infrastructure by revealing it to the players.

The system was designed to address the connection problems faced during the deployment of George Square. The system was also designed to further explore how ubicomp technologies work over large urban spaces, and to encourage individuals to reflect on their experience between plays, adapting and changing their strategies based on the insights gained.

By using the seams in the wireless infrastructure as a resource for Treasure selectively revealing the network coverage was extremely important. The players were able to use the wireless coverage map, built up collaboratively by all of the players, to find where it was best to ambush other players and upload coins. This revealing of the infrastructure made disconnection explainable and therefore the users were able to understand why uploads, for example, failed. When thinking about supporting impression management being able to understand why things happen means that users are able to explain them to others to justify any action that may occur, inadvertently or purposefully.

Revealing the underlying infrastructure also gave the players a resource through which to reflect on the games network. During plays players reported discussing where the best places for uploads where, places where there was high network strength. In the case of Treasure the key in supporting reflection was giving the players time between plays, enabling them to discuss the game and different strategies. Reflection can also be supported in several other ways however; the simplest way is by increasing the number of plays or even the overall duration of the trial. Therefore understanding can be built up and individual players' strategies are given time to mature.

In summary, this section has outlined several key guidelines to support appropriation and reflection, two key areas in impression management, namely:

- Selectively reveal the underlying infrastructure to support appropriated system use.
- Design for disconnection.
- Enable users to reflect on their experience by increasing the duration of the experience.

A.3. Feeding Yoshi

A.3.1. Introduction

Feeding Yoshi is a mobile multiplayer game played over a week. The game itself does not restrict the movement of the players, enabling them to move around, in, and between different cities. Rather than being built on the assumption of users' continuous engagement over a prolonged period of time, it is assumed that players use the system intermittently, as they go through their normal daily routines of work and leisure. Feeding Yoshi is a game designed to open up where and when people play, freeing them from location and time constraints, often imposed, to explore how technology is incorporated into everyday life. Thus providing new opportunities to play and appropriate their use of the system. This is supported using public and private 802.11 wireless networks, deployed throughout the urban environment, as resources within the game.

Feeding Yoshi was also designed to further explore disconnection and seamful design. Consequently the impact of location and other people, on play were seen and highlighted their significance to impression management. The main objective of Feeding Yoshi was to collect fruit and feed various Yoshis that in habited the world. The game itself facilitated team play be enabling players to swap resources with other players. The experience described in this section took place over an extended time period of a week and over a large geographic area spanning three cities.

A.3.2. System Overview

The aim of Feeding Yoshi is for each team of players to collect as many points as possible, by feeding Yoshis the fruits they desire. Yoshis are creatures that are found scattered around the city and are constantly hungry for five fruits, from seven different varieties. In order to collect fruit, players must first collect seeds from the Yoshis themselves—each Yoshi always has a seed for the fruit it most often enjoys. These seeds can then be sown at plantations that can also be found scattered around the city. Once a seed is sown, the plantation will begin to generate fruit, which can then be picked and used to feed Yoshis. Feeding a Yoshi one of his desired fruit scores 10 points, but feeding several fruit simultaneously gives more points, for example, feeding all five desired fruits at once scores 150 points. Feeding a Yoshi a fruit it does not want results in the player losing 10 points.

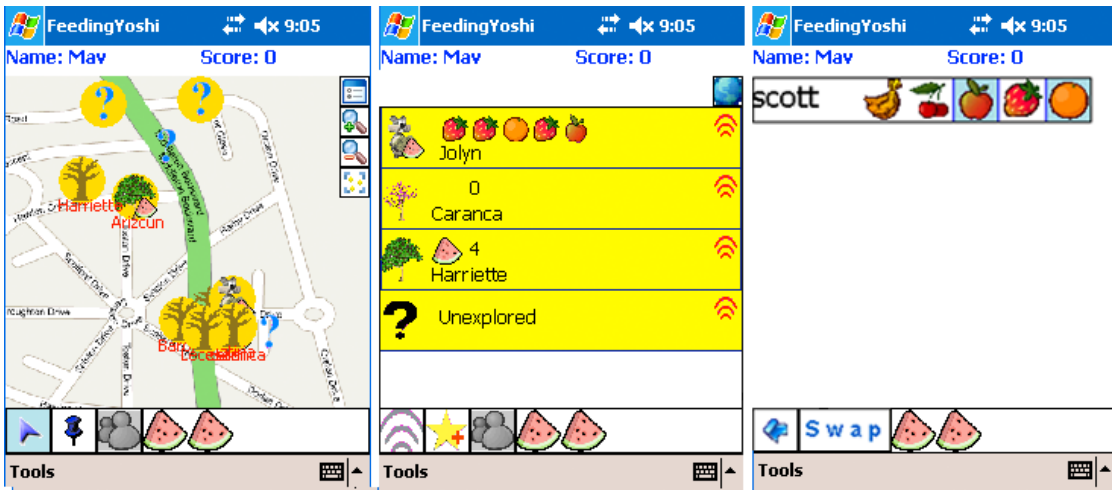

Figure 12: Feeding Yoshi interface. Left: Map view showing Yoshis and Plantations placed geographically by the users. Middle: List of nearby Yoshis and plantations that they user can interact with. Right: List of nearby peers and the fruit they have so that a swap can be initiated.

As a player moves through the city, nearby plantations and Yoshis appear as names in a list and as icons on a map. An audio alert is also played when a plantation or Yoshi is detected so that the player does not have to continually look at the PDA screen. In the map screen (see Figure 12 left), Yoshis and plantations are shown as icons, and navigation controls are provided to manipulate it. Near the bottom is a row containing (from left to right) a button for selecting icons, pinning an icon onto the map, initiating a swap with another player (greyed out), and the basket of up to five fruit: in this case two melons. On first being detected, a Yoshi or plantation appears in the centre of the currently displayed area of the map, although a player can 'pin' a Yoshi or plantation icon in a better place. On the right hand side of the map are buttons for switching to a list view rather than the map, and for panning, zooming and selecting a Yoshi to be highlighted on the map as a 'favourite'. If players change to the list view only the Yoshis and plantations nearby are shown (see Figure 12 middle). Clicking on a Yoshi brings up a screen showing the Yoshi (see Figure 13 left), a seed for his favourite fruit, and the five fruit he currently wishes to eat. Similarly, clicking on a plantation leads to another screen with either a tree with no fruit (unseeded plantation) (see Figure 13 middle), or a tree with fruit ready to be picked (seeded plantation) (see Figure 13 right). To seed a plantation a player must first collect a seed from a Yoshi, find an unseeded plantation, select the seed collected from his/her basket and click the seed button.

Figure 13: Feeding Yoshi interface—when connected to an access point the users are presented with a Yoshi or a plantation. Left: Yoshi is shown with the five fruit he currently wants and a seed for his favorite food Middle: Shows an empty plantation and the final screen shows a plantation Right: Shows a seeded plantation growing apples.

When two players approach one another, each is shown an icon indicating there are players nearby. Selecting a nearby player's icon triggers an opportunity to swap fruit and seeds (see A.3.4.5). This is useful if there are Yoshis that want fruit not grown nearby, and the seeds to grow that fruit can only be gathered from elsewhere. By swapping seeds with team mates who have access to other areas, a team may gain more points without having to travel to far off locations. Swapping is also intended to encourage simultaneous play and to make the game more fun to play together. Lastly, the game has a webpage with a scoreboard showing each individual player's score, as well as the total score for each team.

A.3.2.1. Technology

The game runs on 802.11 equipped PDAs. The trials ran on a mixture of HP iPAQ 2750s and 4150s, which have built-in 802.11 and, due to their small form factor, were relatively easy for users to carry with them throughout the week. The Yoshis and plantations that are detected while playing the game are actually wireless access points. As a player moves around in the city, their PDA continually scans for the presence of wireless networks. Secured wireless networks become Yoshis and open networks become plantations. While it would be an easy and in some ways a graceful solution to communicate with the Feeding Yoshi game server via the open access points that are discovered (for example, to automatically upload scores), it was a matter of debate as to whether using open networks in this way was legal. In some countries, including the US and UK, opening networks up to neighbours and passers-by may be a common and deliberate practice [75]. In order not to encourage our players to potentially break the law, Feeding Yoshi does not transmit any

data over the open networks that it discovers; it only detects their existence and identity. Instead, players have to manually upload their scores at the game website using a 'score voucher code' that is generated by the PDA. By displaying the score on a publicly accessible scoreboard the game remained competitive between the different teams. Indeed, players reported that they often felt a strong urge to play immediately after checking the leader board and seeing their score was close to another team or player's score.

Swapping fruit between players is achieved through 802.11 peer-to-peer ad hoc networking between the PDAs. Each game client continually broadcasts its own existence on a specific ad hoc network SSID while also scanning for broadcasts from others' PDAs on the same network, all in a way that emulates ZeroConf[22]/Bonjour[23] service discovery. When another PDA is detected and one of the players wishes to initiate trading, that player's PDA stops scanning and sends a message requesting the other PDA to cease scanning too. This is important as the constant scanning is a relatively heavyweight task for the 802.11 equipment on standard PDAs. The exchange itself is done using asynchronous communications, since connections can often be lost in a mobile setting.

A.3.3. User Trial

The aim of studying Feeding Yoshi was to explore ubicomp systems deployed over a large time and space. While this was initially laid down as the main motivation for studying Feeding Yoshi much of the inspiration for the study was exploratory, using the system as a probe to understand how technology is fit into everyday life. As a consequence of this several other issues relating to location and those the players inhabited the world with were highlighted. This exploratory approach produced many insights into how individuals played Feeding Yoshi and how they presented themselves appropriately in different situations. This adaptation of presentation based on people and place is ongoing in everyday life however, Feeding Yoshi provided new, and confirmed old insights into how impression management is done.

A.3.3.1. The Method

The players received £20 worth of Amazon vouchers for their participation. However, to make the game more competitive, there was additional prize money for the winners A daily diary was developed and tested during a pilot game in order to get specific insights into the play and the participants' other daily activities. Participants were also interviewed

[22] http://www.zeroconf.org

[23] http://en.wikipedia.org/wiki/Bonjour_(software)

individually after the game. The system was extensively logged and a significant amount of data was collected to assist in tracing the teams' patterns of play. After the trial this data was collected, and the diaries were initially used to inform the semi-structured interviews. They were also helpful in identifying interesting periods of time to be looked at in the log data. The interviews were transcribed and coded to identify significant themes

A.3.3.2. The Users

During the game, there were four teams, each with four players, playing in three different urban areas in the UK: Glasgow, Derby and Nottingham. Two of the teams were based in Glasgow, one based in Derby and the final team, based in Nottingham. These cities were chosen to give a mixture of different settings so that the impact of location on the experience could be investigated. Glasgow is a densely populated large city, whereas Nottingham is a medium–sized city, which contains a mixture of densely populated areas as well as more quiet suburban areas, and Derby is a small city mostly of suburban character. In addition to the game spanning several different cities, some participants traveled to other areas during the game, especially over the weekend. This resulted in the play being moved to a new location, but occasionally meant players would not play.

Teams	Female	Male	Age range
Glasgow1	3	1	22-30
Glasgow2	1	3	22-25
Derby	1	3	23-29
Nottingham	1	3	26-27

Table 6: Feeding Yoshi users.

Teams of players who knew one another were chosen before the trial and who might feasibly be expected to meet throughout the period of play, providing opportunities for collaborative play. Within each team, all were well acquainted with each other and some were close friends. To provide the opportunity for 'multiple plays' or more specifically more long-term use the teams were asked to play against one another for one week. The players in the Derby team were all colleagues who worked in the same organization and who saw each other most weekdays. The first Glasgow team (Glasgow1) consisted of friends and co-workers, including one couple, and three who worked in the same building. The second Glasgow team (Glasgow2) contained friends and acquaintances. The Nottingham team was made up of friends working in the same company, although they did not necessarily see each other during the day, except for two who were flat-mates.

The participants that were chosen were not in the computer science or HCI fields, but instead came from a variety of other professions. Three of the participants from Glasgow1 were graduate students of biology, the rest of the participants held jobs such as bartender, personal assistant, technical project worker or artist. They were all familiar with computers and often with PDAs as well. Half of the participants played computer games of some kind on a regular basis. One quarter played games once in a while with the remainder playing infrequently or not at all.

A.3.4. Findings

A.3.4.1. Everyday Life

In order to take advantage and make use of the opportunities for collaboration, it was imperative that Feeding Yoshi could be woven into everyday life, enabling players to include friends and family, and play when going about their everyday tasks. Successfully embedding the game into everyday life was determined by the extent to which the team structure reflected likely encounters between team–mates. Also, interweaving the game with everyday life meant managing interactions with 'outsiders' including family, partners, colleagues and strangers.

A key factor in successfully playing Feeding Yoshi was the amount of time that players were prepared to invest in the game. Given that Yoshis and plantations were inexhaustible resources, the game rewarded players who were most prepared to search hardest for them and then spend the most time sowing, harvesting and feeding. The Derby team did this and won with a score of 58060, the other teams scores were as follows, Glasgow1 45190, Glasgow2 11250, and finally Nottingham 8190. The time spent playing the game was structured in various ways however, and two general modes of play were observed that impacted the patterns of everyday life in several ways.

A.3.4.1.1. Fitting With, and Changing the Patterns of Everyday life

The first mode was to change one's patterns of everyday life by deliberately setting aside time for special, often relatively prolonged, game sessions, perhaps during the evening or weekends. By intensively playing in this way at the start of the trial, the Derby team gained an advantage. This disheartened some of the other teams as they felt this initial surge was insurmountable, but some players did report that this spurred them into action to try and close the gap. Some of the other teams had constraints on when they could play, for example the Glasgow1 team could not play during weekdays because they were at work.

However, they did play during their lunch breaks and at weekends. While they were constrained, Glasgow1's motivation to try and catch up with the Derby team meant that they finished in second place. Glasgow2 and Nottingham played in very short sessions, however there was one exception in the play of Glasgow2, where one player phoned up and harassed a team mate into playing, which they then did for several hours.

The second mode of play involved augmenting daily routines by interweaving the game with normal activities, most notably work and journeys, and consequently playing larger numbers of shorter turns. The week–long game developed in terms of the total number of turns played by each team on each day. From the interviews, it was clear that the number of turns was a good indication of how well the game was blended into a player's everyday activity. Players who reported taking many turns interleaved them with other activities, to avoid severely disrupting the routine of their day. The two most successful teams employed both modes of play. On workdays their play largely augmented their existing activities, whereas at the weekend they changed their normal activities playing in specially organised session. In contrast, the least successful pattern of play was that of Nottingham, who played for only a few short periods. In their interviews they indicated that not only were they discouraged by Derby's score of over 10000 points on day one, but that their everyday activities did not take them anywhere with a good distribution of Yoshis and plantations.

Beyond these broad categories or modes of play, the players reported that the game had some specific impacts on the patterns of their lives. The impact on work was a factor for many. Some gained an advantage by being able to play at work where WiFi was available, including three players in the winning team (Derby). A few reported that they most enjoyed playing the game when they should have been working, although several noted that less work was done and one player from Derby commented:

> *"I think we might have got into trouble at work".*

Another notable feature was playing during journeys, especially to and from 'town' as part of the daily commute, to go shopping or to meet friends. Players felt that journeys were good times to play, as they had to move through the city and therefore encountered many Yoshis and plantations. Everyone in Glasgow1 augmented their journeys with play during weekdays, as did two players in Glasgow2 and two players in the Nottingham team. Their

strategy was to remember the different Yoshis and plantations encountered during, for example, the bus ride to work, and pick fruit and feed Yoshis along the way. One player from Glasgow1, said that she specifically brought in an orange seed from her home neighbourhood because she remembered that they were difficult to find at her work. After she had seeded an orange plantation, she could feed almost any Yoshi in her work area when she went out to lunch. Several players also noted that playing the game in this way made them late for work, late getting home, or late for prearranged meetings.

Many of the participants started planning their time with Yoshi in mind. Besides going out to play specifically, five of the participants (one from Nottingham, two from Glasgow2 and two from Glasgow1) would take a different route to their destination, either for work or leisure, in order to play Yoshi. One participant from Nottingham explains:

> *"I'd take slightly different street routes than I'd normally take; initially to see what was there. Once I realised there was good stuff there then I would adjust my route".*

The game was most easily played walking around, but it was also played in cars, buses, trams and trains, and even when cycling. Players saw it as a welcome distraction from everyday commuting. Players did not play while driving due to the obvious dangers of doing so, however, a novel way of playing Feeding Yoshi in the suburbs was invented by Derby, which they called 'Drive-by Yoshi'. One of the team members would drive the car, while another would play the game. The player would ask the driver to slow down when they were near useful access points so as to pick fruit or feed Yoshis. According to the two players, this had been great fun, but only worked in small streets with little traffic. One person played while cycling, stopping when he heard that a wireless access point was near. This visible change in behaviour and in particular movement, provided opportunities for strangers to engage with players and made the players very aware of how they acted and interacted with people in the street. By exploring how technology was integrated into everyday life two significant factors relating to impression management were reaffirmed. These issues concerned location and the perceptions of other people.

A.3.4.2. The Impact of Location on Impression Management

Managing one's own behaviour based on the location one finds oneself in is extremely common with individuals explicitly considering how the subsequent impressions they give and social interactions they have with others might be perceived. In Feeding Yoshi this

resulted in players referring to places that felt 'good' and places that felt 'bad' to play based on how one might be perceived as well as the distribution of game resources. For example the players who invented 'Drive by Yoshi' could only do so in areas where there was not much traffic. The reason for this was that they feared that they might be seen in an unfavourable light and be construed as bad drivers or as acting suspiciously. One player stated,

> *"I'd slow down as much as I dared and Owen would be there with the PDA trying to frantically seed and feed a Yoshi while it was still in range. I'm just very grateful we didn't get caught by the police and accused of kerb crawling or something."*

This shows that while suburban areas where the best for this type of play, the perceived risks, made the players feel very uneasy. The feel of play here is heavily influenced by the potential risk of misrepresenting oneself and the image one wishes to convey—especially to those in authority such as the police.

In other locations such as crowded shopping precincts, while it may have broken everyday norms to walk into someone, the repercussions of one's actions were generally not thought of as being as serious. The players also stressed that accidentally bumping into someone would have been explainable, much like being on the phone, and with a quick apology the encounter would quickly pass. In this way players continuously reflected upon their own actions, trying to pre-empt how they would be received by others. This reflection was directly related to the locations that the players found themselves in. In another example, a player reported feeling uncomfortable in industrial and business districts where there were surveillance cameras:

> *"The industrial area over the road from my house. Lots of Yoshis and plantations but too many cameras and security guards."*

These examples show how people reflect on what they might do, and trade off the cost of their actions with the benefit they might gain. While the repercussions here concerned how they would be construed by others, there were occasions where users were simply too afraid to play in particular areas of the city. One player (the water engineer), unfortunately, reported that he could not play when working, for fear of getting 'mugged'. It had been made clear to all the participants that they would not be held responsible for the PDA if

something like that happened but, when explaining the danger of these areas to us, he asked rhetorically:

> *"Why do you think we have this little black button under the dashboard in our car?"*

He was referring to a panic button added to his van. Consequently he played very little and obtained the lowest score in his team (Glasgow2). While it may feel dangerous or risky to play in particular areas, other areas just made people feel foolish. The distinctive movements of game play often resulted in drawing attention to oneself in a way that one would try to avoid in everyday life. Feeling foolish was something players regularly expressed but it was never something of great concern, most likely due to the short duration of the trial. In fact it became something of a talking point between team members. While locations could feel 'bad' to play there were many locations that felt 'good'. Even areas where there was an element of risk to play could feel 'good', in part due to the illicit nature of playing there. Other players enjoyed more familiar settings such as in and around their homes. For example, one player mentioned how good it felt to feed her local Yoshi while in bed at the end of a day (seen in the Personalisation and Attachment section).

A.3.4.3. The Impact of People on Impression Management

While location can influence one's behaviour, it is how one might be perceived by others in a particular setting that drives how one acts. In Feeding Yoshi there were several different categories of people that influenced how individuals played. Unsurprisingly other players had a significant impact on how people played, providing competition and motivation to the players. The rivalry experienced between the players could be seen at two different levels. There was rivalry within and between teams, rivalry within a team occurred predominantly at the beginning of the game with players sharing 'banter' with one another trying to see who could get the most points. Once players began uploading their scores to the server they were able to see their team's score, at this point the individual competition receded, and competition between teams grew. The following participant describes this evolution from 'in-group' to 'out-of-group' competition:

> *"Erm, there was a lot of competing to start with, but then it turned out we could get more points by interacting with each other and swapping the fruit as and when it was needed. So it sort of became us against the other teams rather than us against*

each other. But at the very start it was a sort of individual effort. It didn't take long for that to evolve into a team effort".

Unlike most other games players who did not achieve high scores were not seen as bad players. Instead, those with low scores where seen as not willing to invest an appropriate amount of time in the game. Several players even expressed that they felt let down by their team as the flowing extract shows:

"I got 7000 … over 7000 thousand. But the rest of my team let me down quite a lot … But I think John was trying, John was trying but his device just didn't pick up as many WiFi signals as me".

The further behind a particular a team were, the more the most active players felt aggrieved at the others not 'pulling their weight'. Often the most active players assumed the role of Team Leader, fulfilling several roles; they coordinated team activity, by organising meetings and collaborative games (see A.1.4.1.1). They also felt the need to motivate their team mates, giving them encouragement, which on occasions turned into harassment, particularly when team members were not participating. One player from Glasgow2 recalls being on the receiving end of such an experience:

"He phoned one night to go out and play it. So we met around nine at his flat and we went out, you know at the … ball thing… at the bottom of Kelvin Park when you are just walking back from Uni?

Just around there we played for a bit. For about, an hour. And again… that was Wednesday. And I think on the Thursday he came into my work and took [the PDA] off me, and him and his friend went to play it in town."

Harassing players was often the result of them not playing or trying to entice them into playing when they couldn't, such as when they were at work. In fact on more than one occasion this player had her PDA taken from her by the 'Team Leader' and given to one of his friends so that play could continue while she was working. While some took to the role of leader others were not so comfortable. By organising meetings and group play they felt that they were forcing people into playing and expressed how they felt guilty doing this, especially when they knew other players had other things occupying their time. These

examples illustrate the lengths to which the self-imposed Team Leaders went to maintain contact with the other players. This type of coordination and collaboration was supported by the design of Feeding Yoshi. By revealing the underlying infrastructure, e.g Yoshis and plantations, the players were given common geographical reference points from which they could organise their activity.

A.3.4.4. Revealing the Underlying Infrastructure

During the weeklong trial the underlying infrastructure and the game itself proved to be valuable conversational resources. The game became something to be discussed between players and those outside the game. Many players incorporated their play into time shared with family or friends, while shopping, out walking or as an independent game session to show them the technology. While the game became something to discuss with others and include them in the play, the players themselves used their knowledge of particular Yoshis and plantations to coordinate team play. Members of similar teams would arrange to meet up nearby particular Yoshis that could be found easily, and explore areas where there was a large density of access points.

A.3.4.4.1. Personalisation and Attachment

As players became more familiar with the game they formed emotional attachments to the Yoshis, explaining their behaviour based on human characteristics. This personification of network hardware provides an interesting insight into how individuals personalised their own experience through their imagination and the playful nature afforded by the game. For example, players developed a familiar way of talking about some of the Yoshis they interacted with. One Derby player expressed it this way:

> *"It got to the stage here where we'd played it that much that we knew exactly who lived where. Kelly lives by the door of the block. We've got Laurence down the bottom. There's Lamar, who's out here somewhere [pointing]. He's always a nightmare to pick up. He'll always want a load of fruit, so you go get a load of fruit thinking 'big score' ... [but] he was the one you could never find when you wanted him".*

He talked about Lamar rather like a pet, although an annoying one because he was often difficult to find. These characteristics and interpretations made the players feel more comfortable with the disparity of network coverage. It is often the case that complaints are made when network connectivity comes and goes, but somehow by attributing these

characteristics to a mischievous pet this variability became acceptable and even fun. The following is another elegant example of this:

> *"There was one [Yoshi] called Sabrina, when I was in Norwich. She was down this road and she really wanted strawberries. So we fed her loads of strawberries. Then we went away and we went all the way round the block and we were the other side of the block and she popped up again. And we were like what is Sabrina doing here. Still wanting strawberries. I really liked the names because obviously they all looked identical, but those names give them that little bit of personality. So I just remembered the names of them in relation to where they were. So in here we had Berry. I think Berry was our wifi. Well I think it was because I switched it off to try and find out which it was. And there is other ones in here."*

This also illustrates the range of wireless networks and how they can stretch out further than may be expected. Also of interest was the emotional attachment that this player made with her own Yoshi. The desire to find out which Yoshi belonged to her led to her turning her access point off and on again to see which Yoshi disappeared, therefore deducing which one was hers. After finding this out, it was discussed later on with others referring to her Yoshi—Berry—in conversation with team mates. Ownership is extremely significant when presenting oneself to others. The artefacts one owns, and those one does not own, can be used to present oneself in a particular way. They can be used to show affiliation and social status as well as many other things. Ownership of a wireless access point is not often thought of nowadays as something that can enhance one's social status; unlike say an iPhone. However, the players themselves noted how wireless might equate to wealth scouting out more affluent areas of the city where they felt people would be ore likely to have it. Feeding Yoshi has shown that hardware can invoke emotive feelings and enhance the experience of an individual if used and presented in an appropriate way most of which was completely unforeseen during the design phase.

A.3.4.5. Supporting Unpredictable Interaction

While many of the interactions in Feeding Yoshi were not predicted by the designers, designing for disconnection provided opportunities for users to make use of the system in these unforeseen ways.

This supported serendipitous interaction with other players, non-players and the surrounding environment as well as more organised, but often unpredictable, game

sessions. One of the major influences for this was the provision of new opportunities for collaboration. Collaboration within teams naturally depended on how much time the participants spent in the company of team–mates. All in all, the more time team members spent together, the higher the score they got. However, this was not necessarily due to trading. It was found that excitement and competitiveness came from being around and talking to team mates, and that much of the benefit in collaborating was in exchanging information about the availability of Yoshis and plantations as much as it was about exchanging seeds and fruit. Participants from three out of the four teams went out together in pairs to play at least once during the game. Some gatherings were planned and others were 'spur of the moment' games. The nature of the competition in the game was friendly, as shown when, by chance, two members from opposing teams came across one another during play in Glasgow. They did not know each other, but had both gone to the city centre to play since there were some excellent playing spots around a shopping centre. The woman from Glasgow1 who met a man from Glasgow2 describes the situation:

> *"I was playing away and then this box popped up saying 'Norman would like to trade' and I thought 'I don't have a Norman on my team!'. Then I saw this guy with a PDA and he was looking around, and then we caught up with each other and we thought 'hmmm… not the same team'. But he walked over and he said that he was from [the other Glasgow team] and could he trade? And well, I was in my prime playing spot so I had all the fruit I needed, [but] I just thought, okay I would trade with him."*

She was initially hesitant because he represented an opposing team and they did not really know one another. Since the game was a week-long game, they both knew that trading with 'the enemy' did not necessarily mean a major loss of points. However, trading prevented her from losing face by seeming like a 'bad sport'. This encounter highlights something very common in impression management and that is the importance of risk (see Section 2.1.1). If her friends were to hear she had traded with the 'enemy' she may not get chastised since it was a novel encounter where major losses would be unlikely, and they would almost certainly have understood the pressure to be seen as cooperative in such a situation. However, if she had played for a much more sustained period of time or even played multiple times with a member for an opposing team this may have been more problematic. Also, in this instance each could glean information from the other player—like a spy—that might help their own play and the play of their team and in fact the girl

from Glasgow1 did note that it was *"interesting to find out how other participants played"*.

A.3.5. Discussion

This section has discussed Feeding Yoshi a mobile game designed to explore how technology is incorporated into people's everyday lives. By studying Feeding Yoshi the impact particular locations and other people have on an individuals behaviour was witnessed. Similarly to Treasure game specific movements could be seen and occasionally provided the opportunity for strangers to open up a dialog with the players. On other occasions, friends and family cooperated with players to share the experience although on other occasions the game got in the way. This meant that players would be given into trouble by those they were spending time with for not concentrating on the activity at hand such as shopping with one's girlfriend.

Location also had a significant impact on how players play. Players had two main considerations when trying to decide where to play, where would have the best distribution of Yoshis and Plantations, and where could one's actions be explained. The first is a common consideration for any game but the second meant that players had to continuously reflect on how their activity might be perceived and weather or not they would be able to sufficiently explain their actions if held to account. The significance of location, and the perception of others, backs up the important elements of context highlighted by [35] and introduces important considerations when designing for impression management. For example, system use itself results in impressions being given off and how this is managed should be an important consideration for designers.

Often such impressions being given off are unforeseen by system developers and when systems are designed to be appropriated then unforeseen interactions will always be observed. When supporting impression management a significant degree of appropriation will always be desired by users to help them distinguish themselves as well as affiliate themselves with others. Therefore designing to support unpredictable interaction would be a primary goal. This can be done by providing flexible systems that can adapt and change as required or by having a tight iterative design cycle that includes the target user group. Feeding Yoshi facilitated these unpredictable interactions by providing the players with ad hoc peer-to-peer data sharing and the open-ended rules of the game.

Finally one of the main weaknesses of Feeding Yoshi was the lack of awareness given to the players about the activity of one another. The online scoreboard provided was the only place that players could get an indication of what others were doing. The players themselves worked hard to overcome this by, regularly talking to one another about the game whenever they met, using the telephone to encourage one another to play, and coordinating collaborative playing sessions. However, this did not provided them with information about what other teams were doing and therefore it was difficult for the players to try and counter the play of the other teams. Therefore, designers should aim to support mutual awareness particularly when the aim is to present one's own activity to others.

A.3.6. Conclusions

This section has presented Feeding Yoshi a multiplayer mobile game, where players must collect fruit and feed Yoshis that are scattered around the urban environment. The system was designed to investigate how collaborative ubicomp can work over a much large time and space. The main aim of the system was to study how ubicomp technology is incorporated into everyday life and through this the impact the game had on how individuals controlled the impressions they gave were observed.

Feeding Yoshi built upon the idea of multiple plays or longer duration trials discovered in Treasure, this enabled users to integrate the game into their daily routines. The players themselves were able to make use of the Yoshi names to commonly refer to good locations to play and often narrated what they had done throughout the day in their discussions with friends and team mates. This longer term trial also facilitated opportunistic play, sharing with family members, as well as fitting the game into more routine activities such as shopping or commuting to work.

Although the recorded data that users could present themselves though was limited, they did use their scores and the Yoshis they discovered as a way of showing their dedication to the game. These two resources were heavily used to position oneself in relation to other team members and other teams. Players used their scores to demonstrate that they were 'good' team mates working hard at achieving the common goal as well as competing against one another to see who was the best. Also the game itself became a resource to position oneself against others such as family and friends showing ones status as 'special' by being only one of a select few players currently participating in the game. Therefore it is important to realise the social capital that exists in digital artefacts and support the

expression of this so that individuals can ‘show off’ their affiliations and ties to other artefacts and people that might gain them kudos amongst their peers.

This section has shown that rich forms of interaction can occur when a system is designed to support user appropriated use. Unforeseen interactions take place and users interweave the technology into their daily activity. The novelty of technology can also act as a means through which to present oneself to others and gain kudos from peers. By designing the system in this way the importance of both ‘insiders’ and ‘outsiders’ to the continued presentation of self became apparent. Players themselves used surrogates to save face and show that they were adhering to the group performance—that of a hardworking team—shown to the evaluators but also to the other teams that they competed against. Addressing RQ2 with this in mind, designers should be aware of the need for others to help support and confirm any presentation of self and where possible use it to their advantage. It could be used to hold individuals accountable for their online presentations that are made (see Chapter 7).

Again, we summarise the lessons or guidelines from this concluding section:

- Support integration into everyday life
- Design for unpredictable interaction
- Support ‘The Team’, including all of the individuals who might be part of a performance designed for the situation.
- Support mutual awareness and sharing of information at a distance

A.4. Castles

A.4.1. Introduction

The Domino architecture discussed in Chapter 6, is an architectural design directed towards dynamic adaptation so as to fit with users' constantly changing needs and environments. Castles is a mobile multi-player game that uses the Domino infrastructure. The object of the game is to construct an army to battle other opponents. To build a successful army, users are required to create a host of different resources that are produced by a number of different buildings. The game was designed to provide players with the ability to adapt and customise their own system setup and play.

Castles, like Treasure and Feeding Yoshi, is a seamful game in that it was designed to selectively expose software structure to users—through Domino—so that players are made aware of the software modules in their current setup. This also enabled players to reveal the comments they had as well as discover components that others had, which they could appropriated for their own contextually relevant patterns of use. A secondary aim of Castles was to further test and develop the infrastructure discussed in Chapter 6 the infrastructure section. By further extending this infrastructure the ad hoc peer discovery and data transfer a component transfer mechanism was provided for Domino. The game itself was also used to explore how players coped with the inconstancies that can arise from the personalisation of a systems setup and the more general interaction.

A.4.2. System Overview

System adaptation and evolution are especially important as the use of computers expands beyond work activities, which are focused on pre-planned tasks, to leisure and domestic life. Indeed, users' modification (or 'modding') of complex software structures is relatively common especially in games—although the skill threshold required for modding is high. Supporting this type of activity using ubiquitous computing is even harder. The variety and dynamism of people's everyday activities, contexts and preferences make it extremely difficult for designers to foresee all possible combinations and uses of software. Instead of relying on the developer's foresight, incremental adaptation and ongoing evolution under the control of the users may be more appropriate. This is the premise behind Domino and its use in Castles.

Castles is a PDA-based multiplayer real-time strategy (RTS) game in which players build up a settlement and battle opponents. It is similar to well-known RTS games, such as Age

of Empires[24], Stronghold[25] and Settlers[26] In Castles, players build various buildings such as wood mills, bakeries and weapon factories, deciding exactly when and where to construct them, and how many resources to use for each one. As with most RTS games, one major goal for each player is to create a settlement from these buildings that efficiently produces and maintains a substantial number of army units ready for battles with other players. For instance, a player may wish to produce many 'knight' units to commit to battle. However in order to do this the player must first ensure that he or she has constructed the necessary buildings to produce enough food, iron, stone and wood. In this instance, these are the resources that are needed to continually supply the player with knights. There are a wide variety of buildings and army units available to the players of Castles, allowing for extremely varied combinations of buildings supporting distinct combinations of units in each army. For example, one player may wish to have an army consisting mainly of mounted units whilst another may try a strategy of having a large number of ranged units such as archers.

The majority of the Castles game is played in a solo building mode, in which the player chooses which buildings to construct and how many resources to use for each one. Each type of building is a Domino module. The goal of this stage is for the player to create a building infrastructure that efficiently constructs and maintains the player's army units (see Figure 14 left). When the game starts, there are over thirty types of building and eleven types of army units available to the player, allowing for extremely varied combinations of buildings supporting distinct types of army. For example, one player may wish to have an army consisting mainly of mounted units whilst another may try a strategy of having a large number of ranged units such as archers. In addition to buildings, there are 'building adapters', which are Domino modules that are able to alter the output level of buildings. Adapters may have different effects based on which building they are applied to. For example, the 'scythe' adapter has no effect if applied to the Knight School but doubles output levels when applied to a wheat field. In order to mimic the way that plug-ins and components for many software systems continually appear over time, new buildings, adapters and units are introduced throughout the game, as upgrades and extensions that spread among players while they interact with each other.

[24] http://www.ageofempires.com/

[25] http://www.strongholdlegends.com/

[26] http://thesettlers.uk.ubi.com/home.php

Figure 14: Castles Interface. Left: Main map area. Middle: Archery building information page. Right: building list showing recommendations.

From the main interface (see Figure 14 left) the users can access all of the other elements of the game, Figure 14 point 1 brings up the building list (see Figure 14 right)., point 2 enables them to see nearby peers with whom they can battle, point 3 shows all of their resources, and point 4 is a general menu that enables them centre their map and close the game—features that were not commonly required. Players can also monitor the progress of their buildings by clicking those they have on their map. This then takes them to an information page that provides them with information about the building (see Figure 14 middle). In Castles there are two types of buildings, *shops* and *producers*, shops are buildings that enable the player to use the resources they build up to buy fighting units. Producers create the resources and do not require the users to explicitly buy them instead they are automatically accumulated into a stockpile that can be used at a later date. They can also choose to demolish their building if they do not require it any longer by clicking on the item highlighted in Figure 14 point 5. At any point throughout the game the players can get recommendations of things to do next by clicking on point 6 which ranks the buildings, point 7 allows the players to list the buildings alphabetically, which is useful if they know what they are looking for and point 8 confirms their building choice taking them back to the map centring on the building they had chosen.

When two players' devices are within wireless range, one may choose to attack another. Behind the scenes Domino also initiates its history-sharing and module-sharing processes. When a battle commences, both players select from their army the troops to send into battle. Players receive updates as the battle proceeds, and at any time can choose to retreat

or concede defeat. At the same time, players can talk about the game, or the modules they have recently collected, or modules they have used and either found useful or discarded.

With such a high number of buildings, adapters and units, there is a significant variation in the types of society (module configurations) that a player may create. Selecting which buildings to construct next or where to apply building adapters can be a confusing and daunting task. However, Domino helps by finding out about new modules as they become available, recommending which modules to create next, and loading and integrating new modules that the player accepts. When new buildings and units are available to be run but not yet instantiated we notify the user of the new additions by highlighting them in the menu of available buildings (see Figure 15 middle). The buildings that the system most highly recommends that the user should construct next are shown when the user clicks the 'star' (recommendation) button. After each battle the players are encouraged to use this to see which new modules they have been obtained and would be best using (see Figure 15 right). Thus, the user has quick access to guidance from the Domino system about how to proceed. If the user desires, he or she can get additional information about recommendations, such as its dependencies or the modules most frequently used in conjunction with it in the past in similar contexts. This information, obtained in a pop-up dialog by clicking the recommendation information button in the build panel, can help the player understand more fully how the module might be used.

Figure 15: Castles trial and component recommendations. Left: The players' physical arrangement during the game. Centre: A new module advertised but not integrated into the system. Right: Information received after a battle that can be used to improve one's future play.

Thus, a new module is smoothly integrated into the player's system without requiring substantial module management, or indeed any knowledge of the low-level transfer or

installation process. The user simply sees the new options and recommendations, and can make use of that information without having to search manually for or install the new modules. On the other hand, Domino does not go too far in automatically loading and running modules. It presents them in a way that lets the user see them as he or she plays, revealing something of their past use, and showing this information to others when meeting and talking with other players. Overall, Domino complements the conversation and discussion among players about new and interesting modules, and eases the introduction of new modules into each individual system and into the community.

A.4.3. User Trial

There were three main motivations behind the study of Castles, firstly was to test the Domino component infrastructure. Secondly, the trial was designed to see how the individual players themselves coped with using such a dynamic and customisable infrastructure. Finally the trial was setup to explore how the exclusivity of components might affect play; in turn this reiterated the significance of having a shared understanding, and hiding and revealing.

During the trial each player begins the game with a different set of possible components (buildings) that they can construct. Access to further game components comes when players begin to battle one another. When players decide that they wish to battle, they both select an army from their overall stock of troops. As they enter into battle, players position their units in three possible locations (front line, back and reserves). Players view the battle screen as the battle proceeds, and can view their army's depletion and the waves of units moving forward. After the battle, players then gain access to specially recommended buildings that their opponent had, and, with these newly available buildings once again return to constructing their settlement.

In Feeding Yoshi, the game inadvertently provided a mechanism through which players were able to narrate their own lives. The 'story' of their activity and interactions was told through the framing of the game. Players worked at controlling the information given to others even though the shared information between teams was limited to an online scoreboard. In Castles there were many more opportunities for hiding and revealing information and several of the motivations for doing so are discussed later in this section.

While this chapter highlights the importance of adaptation and in particular the need for individuals to be able to dynamically adapt their system configurations to best suit their

own need, in order to support impression management through the use of such a component architecture it is imperative that a shared understanding of how components are used and what is meant by having particular configurations can be maintained. As part of the Domino architecture this is supported through the recommendation system that helps players understand what others are doing and, in practical terms, what it means to play in particular ways.

A.4.3.1.1. The Method

During the trial the system was extensively logged and the participants were filmed while playing. At the end of the trial the participants were interviewed in groups of two and asked about their experience of the game. The player setup meant that the players sat in a square as shown in (see Figure 15 left). This meant that to video tape the reactions of the players two video cameras had to be used. These multiple video sources along with the log data were then synchronised in Replayer [129] and analysed alongside one another. The interviews were used to highlight elements of the game that should be focused on as well as providing valuable insight into how the users made sense of and used the features in the game. In the following section the findings from the analysis are presented.

A.4.3.1.2. The Users

The trial consisted of six separate game sessions, with four participants in each. Where possible groups of four where all of the players knew one another were chosen before the trial. Two of the groups that played consisted of two pairs of friends (four players in total) that new one another well but did not know the other pair at all. There were a total of 23 male participants but only 1 female participant. All of the participants were students, with most having a background in computer science. Most of the participants reported playing computer games regularly—more than once a week.

Each game lasted one hour, with every player battling every other player once, making a total of three battles for each player per game. At the start of the trial a short tutorial on how the game is played was presented, and the participants were then given the opportunity to familiarise themselves with the game and its controls. Each trial lasted approximately one hour, with three 10 minute solo building rounds during which participants created buildings and army units, and three battle rounds against each of the other participants, lasting until there was a winner.

A.4.4. Findings

Along with the recommendation system, shared understanding was achieved though discussion and storytelling conducted during play by the participants. By each taking their turn [115] to expose their state of play and discuss any problems faced, the players

collaboratively built their understanding of the game. Storytelling involved players commenting on the game events and sharing their experiences with one another. This shared experience meant they could inform one another of their play, collaboratively overcome any issues they had with the game, and augment the game with additional 'banter', making it more fun to play. Therefore the game can be seen as a collaborative storytelling exercise that framed the game in a friendly and competitive atmosphere within which players felt comfortable exchanging banter with one another. This banter was augmented with a series of physical gestures designed by the players to animate exchanges they shared, making the game a more fun and collaborative pursuit. These gestures included punching the air after winning a battle, pointing at the PDA and opponents, and facing up to an opponent—turning and directly facing opponents when in battle. These issues will be further discussed in this section.

A.4.4.1.1. Understanding the game through stories

There is an interesting tension between competition and collaboration in Castles. Players in vignette 2 below are working through the nature of the architecture in their discussions. However, the paradox here is that in discussing the nature of the architecture, players can also give away information, making others aware of their tactics and strategies for play. The system architecture prevents others from observing these tactics directly, so while players are revealing this information though their talk they have the opportunity to conceal more crucial information. While it does not seem to make sense that players would share information with one another when competing there are several reasons why this is the case. As an analogy, poker players can use information sharing to provide false information (bluffing) and therefore strengthen their position as a successful game player. Sharing information can also be altruistic, enable players to gain kudos within their social groups, or animate the game and make the experience more enjoyable. It is also the case that a victory against an individual who is much weaker than oneself may lack challenge and therefore feel hollow, and so by sharing information the other player improves and future battles may become more engaging.

Players of Castles, unlike those of many other conventional games, start off with different sets of components. This creates a disparity between the different views of the system each player has. For example, one player may have a 'barracks', a 'knight school' and a 'fish farm', whereas another may have a 'barracks', a 'spearman school' and a 'bakery'. The following comment illustrates this,

"After the first battle I thought I'd done something wrong, [then I realised that] only some of the units were available to some of the people".

When the players' noticed that they had different sets of components they realised that revealing all of their resources might be to their disadvantage. However, to learn which components went together they needed to know which other components were available. Therefore as each game progressed the players began revealing some of their components so that they could work out who h the other components that they required to build specific units or resources.

In each trial, there were three occasions where the players battled one another, so that every one of the four players fought every other player. This gave the players several opportunities to banter with one another, and often involved them commentating on their play and the play of others. The following extract is indicative of a battle commentary:

Vignette 1:

Henry: I'll have you

Pete: Oh good fighting

Philip: [Mumbling] Let's put only peons in the front line

Pete: There's a tactic for you I'm actually battling you with one villager with a stick

Pete: [after the battle] oh I lost

Henry: You coward

Philip: He is saving all of his stuff for the last battle

Henry: Coward

Pete: I have only got like four men what am I gonna do anyway there is no point killing them

Henry: Why didn't you build more army?

Pete: I have got no men. [Receives a new component] Ah spear school!

Philip: What did you get?

Henry: A spear school and encampment. Hey [now] I have no peons!

...

Henry: I trashed his army of one peon (laughs). A mighty army! Fish farm whey hey!

Pete: Fish farm is great its free food

Henry: Why didn't you build more army?

Henry: [Receives new recommended components] I have got no men… ah spear school

Pete: What did you get?

Henry: A spear school and encampment … hey hey I've got no men

Henry: I trashed his army of one peon [laughs] a mighty army… Fish farm whey hey!

Pete: Fish farm is great it's free food

Philip: I had loads of army units

…

Henry: I had a fair few

Pete: I'm better than you na na

Neil: I had 130 archers alone

Henry: finally my bakery [is] working

Neil: I win

Philip: I lost again that's crap

Philip: I should have saved them for the last battle

Pete: See tactics mate

Henry: Tactics my ass

Pete: This will be a lap of honour

This is an excerpt of a typical battle. At the beginning, a series of tactical manoeuvres is commented on, *'I'll have you'*, '*lets put only peons in the front line'*, and *'There's a tactic for you I'm actually battling you with one villager with a stick'*. All four players are battling: Henry and Pete are fighting one another, and Pete is fighting Neil. These three comments show several different aspects common to the conversations had in Castles. The first shows confidence and playful banter with his opponents. The second phrase is designed as a bluff; peons are the weakest units in the game and therefore they should not be used in battle, instead they should be trained to become soldiers. Indeed, when looking at the log data it could be seen that Philip did not put them in the front line. The third and final statement is setting up a joke. At first it seems that it is a bluff however, as the encounter progresses it can be seen that in fact Pete is setting Henry up for a fall. While he wins the battle it seems like an empty victory for him and therefore he feels the need to taunt Pete Due to the taunting, Pete feels the need to defend himself, stating how many

fighting units he has, however this is exaggerated to make a suitable case to the other players.

The commentary proceeds the 'playful' element of the conversation continues. Although the conversation moves from the battle to the more solitary aspect of the game, building up one's 'village', resulting in resources to increase one's army. Even in these periods of play, where the game is individual, the players discuss their play to share their experience. In the segment just after the first battle between Henry and Pete, the players discuss in depth which new components they have received. Making this information public takes away the element of surprise, however it adds fun and banter to the game. This trade off was seen in many encounters.

The final segment of this conversation is the commentary of Neil's battle with Philip. Neil speaks for the first time during the encounter, to join in with the banter, however it is Henry who says, *'finally my bakery [is] working'*. This is a reference back to a discussion the players had at the beginning of the game vignette 2. This discussion focused more on the game dynamic and how the underlying infrastructure of the system worked. It is this type of conversation and the stories people told to explain the game that will now be explored.

While much of the discussion focused on the happenings within the game, there was also significant discussion about the game that directly reflected the underlying infrastructure. Since the component-based Domino infrastructure that Castles used was unlike any other in the games the players had played previously, making sense of this was extremely challenging. As has been stated, the disjoint view of the environment that each player had due to the dynamic component–sharing architecture led to negotiation, discussion and the sharing of information between the players. It would often be the case, especially early in the game, that players had components that they could not use because they lacked required components. Therefore the early discussions focused on the relationships between the components, and how the game dynamic supported the sharing of the components and the way they should be used. Achieving this understanding became a collective endeavour in which all of the players helped one another. The following extract is indicative of this type of collective learning:

Vignette 2:

Pete: Where do you get the flour from? [Little pointing gesture toward display but eyes stay on the device] Anyone know?
Henry: We haven't worked it out yet (laughs)
Neil: [Looks at Henry] You need wheat fields that give you wheat [gaze moves round the other players, everyone else remains fixed on their PDAs] and then you use a mill [gaze moves back to his own PDA] to create flour.
Pete: Ah right!
Henry: Well you see I don't have a mill. Maybe I still have to discover it from you guys?
Pete: How did you know if you have a mill?
Neil: [Looks up at Henry but Henry's gaze remains directed towards the PDA] I sorted things alphabetically?

From analysis of the log data, we can see at this point that Philip lists his buildings alphabetically and joins in during the next exchange.

Henry: Aw well, as I say, I don't have a mill.
Philip: ... Neither do I ... which is crap!
Henry: (laughs)
Pete: Nope, no mill [looks across to Neil] Just called 'mill'? [Looks back]
Neil: Yeah
Philip: I've got the sawmill? [Small hand gesture]
Pete: It's close, I'm sure you could make some wheat in a sawmill [scans the list of buildings with the stylus] ... I've not got anything that makes flour.
...
Philip: [Gestures with the stylus hand] does anyone have the mill?
Henry: Noooo! Well [raised eyebrows] he has the mill [points to Neil with the stylus but does not take his eyes off of the screen]
Philip: Are we going to battle him? [Looks toward Henry, laughs]
Henry: [Laughs, gaze still remains on the screen] We are going to rob his mill
Pete: Nope, none [sighs, shuffles in chair]

This extract shows the players working through the problem of making sense of the links and relationships between game components within the game. In this sequence only Neil has the *mill* component that is needed to produce flour for the bakeries. Until Neil battles

the other players, they do not know of the mill's existence except though their discussions with one another. This fact must be resolved by the players as they compare their individual perspectives on the game; perspectives which are subject to the underlying component software architecture. It is also possible that players are more familiar with other multiplayer games where the resources available are typically accessible as a series of levels rather than shared as components between players.

By asking *'Where do you get the flour from?'*, Pete opens the discussion. This comment is broadcast to all of the players and is met by a response from Henry who states that the group haven't worked that out yet. However, without the help of Neil, the players would not be able to find out how to make flour since he is the only player with the mill component. Not only does Neil explain the relationship between the components, he goes on to explain how best to search through the components. Sharing this understanding and expertise helps improve all of the players' understanding of the game. Again, this would seem to conflict with the players' aim of winning the game, although it may be that learning about the game is an enjoyable social activity in itself, and there is no satisfaction in winning against someone who is significantly worse. Levelling the competition in this way is something that is very common in competitive games and sports, golf being a fine example. In golf, players have handicaps that allow players of different proficiency to play against each other on somewhat equal terms. Looking back to vignette 1 it can be seen how winning against a severely weakened opponent is not satisfying and in this case resulted in Pete being chastised for his actions. Again, the exchange continues into a more light–hearted discussion, with the players joking about using different components that have a similar name but are obviously designed for a different task. Finally, the players resolve who has the mill and who does not have it, with Philip and Henry revealing how the mill might be obtained through placing the components spatially in the ownership of Neil. This is done through jokes, deictic talk and gesture, all of which will be discussed later.

A.4.4.1.2. Software as Positional Goods

Ownership provides individuals with the means through which to construct the identity they wish to present to others. In this section the author will look at the ownership of software and how it can was used as a positional good in Castles. In Section 2.3.3 positional goods were defined as artefacts that support distinction by dividing their audience as well as being identifiably new. Therefore in Castles the modules were deliberately divided up so that different players had different components, thus increasing their uniqueness within the group and making them more desirable. The key to positional

goods is ownership of these desirable artefacts. Already in this chapter the importance of ownership has been shown especially when it came to controlling the information players revealed and concealed from one another. In the previous example, information was 'given off' by the game and through this the 'outsider' was able to accidentally reveal private information. With this type of information, leakage is extremely common in online presentations. For example, information about oneself cannot be fully controlled, as third parties [72] can talk about our actions with others.

Another compelling example is the forcefulness in which players maintained control over their PDAs even when they were receiving help. In vignette 2 above explicit ownership of software is discussed, the players assign ownership of 'the mill' to Neil and reveal the underlying mechanism through which they must use to obtain it. They playfully suggest that they are going to 'rob' him of his mill by battling with him. There is a clear desire here to get access to this item which enables Neil to create food while they cannot and this desire stems from a lengthy discussion that can be seen throughout vignette 2 where the group ascertain that they have different components and which components work with one another. This example is indicative of the play in Castles and shows how the component based architecture not only enabled players to customise their own setup and play but also supported the use of software as a positional good. The following extract is another example of how the software components one had increased their status as players:

> *Tony: "When cannons got mentioned by Eve, I was like, damn, I've only got catapults"*
> *Andy: "Yeah, when you can see people have other things, it's almost like envy"*

In this example in particular the players note that they knew what others had, even though this was not explicitly shared by the system, and how they were particularly envious of those who had things they did not but wanted. This shows how the components became status symbols between the players, with players being known for the components they owned. The components themselves became like commodities that people were keen to keep to themselves, to maintain their individuality and often their strength over others. The author will now discuss the implications of Castles and its subsequent analysis.

A.4.5. Discussion

This section has concentrated on adaptation and customisation; these were supported at a system level through the Domino component framework. However, the players themselves also had to work to make sense of the underlying infrastructure to enable adaption and

customisation. The players were able to make sense of the game through, stories, commentary, and banter. This enabled them to develop an understanding of the game, and the underlying infrastructure. The players could be seen to use these exchanges to their advantage both socially and tactically. Some would help and gain kudos from being the person ‘in the know’ others would use the exchanges to bluff their opponents. Players also used aspects of the game to present common game ‘faces’ to overplay or underplay their hand as appropriate, adapting their use to the game’s context, as well as the social context they were in. These exchanges were inherently paradoxical, with players seeking to help others and share the experience, but on the other hand they had to be extremely selective in what they shared, otherwise they could loose. Therefore hiding and reveal became extremely important, however sometimes impression were ‘given off’ that revealed the ‘truth’, such as body gestures. Some of the in game resources such as the recommendations could also be used to gain an insight into the true strategy of others. For example, several players used the recommendations to predict and understand the play of others, enabling them to ‘counter’ their tactics.

One of the key concerns of computer-mediated communication is the disembodied nature of it. The lack of common feedback such as facial gestures, body language and other physical gestures can cause information to be misinterpreted While gestures might ‘give away’ information it can also be seen how they are carefully crafted to convey information while playing Castles. In the examples discussed above gestures were used to implicitly show one was having problems rather than explicitly stating it. Other gestures, including body orientation and how it was used to ‘face up’ to an opponent, convey lots of information that is lost when one presents oneself online. It is important for designers to recognise this and provide, where appropriate and possible, the use of gestures and everyday activity into online presentations. This also follows from how individuals used their friends and family in Feeding Yoshi to maintain the image of being a “hard working” player. While the Castles game did not support this explicitly, the players used the close proximity they found themselves into augment the game with stories and gestures that enabled this type of expression.

To ensure that individuals are able to distinguish themselves from others and adapt and change the presentations they give over time customisation and adaption must be considered and supported. In this section the author has shown how component architectures can be used to support such dynamism. However, exclusivity and ownership

are also extremely significant when trying to present oneself to others. Whether one constructs their identity through the use of cloths, cars or other artefacts, these items are used to distinguish one from others. Component architectures can also provide a means in which individuals can position themselves against others especially when components are particularly rare and desirable.

A.4.6. Conclusions

This section has built on the integral part that adaptation has to play in impression management. While individuals adapt their behaviour and use of technology on a daily basis often system designers do not support this behaviour within their systems. Component architectures provide a rich opportunity for users to construct their own dynamic narrative (framed within the specific context) as has been seen through the play of Castles. Therefore it must be reasonable to suggest that this shows that creating an individual personal narrative (framed within their everyday life) must also be a good opportunity for this type of architecture to support.

The historically logged information shared through recommendations, provided support for users to build up a shared understanding of the game and the underlying technology, by giving the players common conversation resources. While the recommendations supported a shared understanding they also enabled players to reflect on their activities and implicitly on the activities of others. The players augmented this shared resource, working hard to discuss, hypothesise and share the information about both the game and the underlying infrastructure.

With respect to impression management, the author has shown the problems that can occur when individuals are forced to use predefined strict categorisations to represent themselves (see 2.3). However, providing users with a component-based architecture can enable them to configure the system to best fit any presentations of self they wish to support. Although without common understanding, as discussed, what particular information represents may be unclear to the audience. Therefore with RQ2 in mind designers should provide dynamic presentations of self but should also support users in building up a shared understanding.

By providing players with customisable system setups, they were able to create setups that best suited their needs. While the aim of such endeavours was to become the best player and win the game, players were also able to make use of their individualised setups as social capital. In doing so, the players assumed ownership over their system setup and the

components they had, stating that they wanted to keep them to themselves. By maintaining exclusivity over the components they had, players expressed that they could gain an advantage over their opponents, and inadvertently, gain kudos for owning exclusive information.

We conclude by summarising the lessons or guidelines arising from this chapter:

- Support a shared understanding
- Support adaptation and customisation within system design.
- Support exclusivity/limited availability of software components.
- Support the use of physical gestures and everyday activity in impression management systems.

A.5. Shakra

A.5.1. Introduction

The decreasing levels of daily activity undertaken by the general public form an ongoing challenge for those involved in public health, and is of concern to both primary and secondary healthcare. The benefits of physical activity are well documented and widely acknowledged, and yet the World Health Organisation state that 60%[27] of the worldwide population are not active enough to profit from these benefits. It has been stated that the recommended level of activity for an adult is at least 30 minutes of moderate activity, five times a week. Although prolonged periods of activity are most advantageous, the daily amount of 30 minutes can be accumulated throughout the day in shorter periods of 10 minutes or more [1]. Most adults who do not currently reach this level of activity may be able to achieve this target by making small changes to their everyday routine. With pervasive and ubiquitous technologies becoming ever more present throughout our everyday lives, capturing and acknowledging everyday activity in an accessible and non-invasive manner, and facilitating the sharing and comparison of that information between peers, has become possible. By increasing individuals' awareness of their own activity, coupled with the ability to share this information, we can provide individuals with added motivation to become more active on a day-to-day basis.

It is also well known that self–monitoring (self–reflection) is a behavioural change technique [98]. To facilitate this, Shakra was designed for use on unmodified mobile phones so that it could be integrated into everyday activity while still supporting both individual awareness and sharing. Although not everybody owns a mobile phone, it is the most uniformly adopted computing technology throughout all social classes, and so this platform hopefully overcomes the barrier to adoption.

The current use of pedometers illustrates how awareness and reflection aid individuals in changing their behaviours and, although pedometers' accuracy may be volatile, they have been found to motivate individuals taking early steps towards a more active lifestyle [123]. As pervasive technologies advance, so does the ability to detect and monitor the physiology and physical activity levels of an individual or a community, and as these advance the more fine-grained this monitoring becomes. A multi-modal sensor board can

[27] World Health Organisation: Move for Health http://www.who.int/moveforhealth/en/

now distinguish between eight physical activities [92], and commercially available technology can be worn on the body to monitor blood pressure, heart rate, and stress levels. These technologies are unarguably useful, but their specialist nature may prove to be a barrier to widespread adoption and utilisation. In contrast to the use of pedometers, and to most accelerometers and GPS units of the time, Shakra does not need special devices that need to be strapped onto the body or carried around for it to track the participant's activity.

Although GPS is increasingly being embedded in phone technology, there will always be limitations that must be taken into account—such as GPS shadows (see A.2.2). For example, while GPS might provide an accurate measure of distance travelled out in the open, it relies on constant view of the GPS satellites. Naturally, this system rarely works indoors, and it can also be problematic in built–up urban environments—this is a result of the 'urban canyon' effect in which 'shadows' appear frequently in large cities where tall buildings block out the satellites' signals. Instead, Shakra had to be able to work both inside and out so that all of the activity done by an individual would be taken into account. In order to achieve this, Shakra detects activity by analysing patterns in the visibility of GSM cells and their signal fluctuation, from which the application can infer whether the carrier of the phone is sitting still, walking, or travelling in a car. This information is then used to calculate the carrier's daily activity level, which can then be shared with and compared to the activity levels of others. By tracking the users' activity in this way, they are able to find out how much activity they were doing with little cost to themselves. In Section A.1 the importance of user–created content was expressed, however as has been stated it can often be extremely time consuming if it is not interwoven into the experience. Therefore integrating automated tracking and recording of activity was imperative in Shakra.

A.5.2. System Overview

As mentioned above, the advance in pervasive technologies has increased the ability to detect and monitor physiology and physical activity levels. However, most of the applications that enable users to track this type of activity require additional hardware. The importance of achieving the recommended daily activity level of 30 minutes of moderate exercise per day has also been stated. By capturing and acknowledging everyday activity in an accessible and non-invasive manner, and facilitating the sharing and comparison of

that information between peers, it was hoped that awareness would be raised in such a way that it would motivate users to become more active on a day-to-day basis

The system was designed to track and categorise an individual's daily activity into accumulated time spent either, inactive, engaged in moderate activity, or time spent in a vehicle. In acknowledgement of the influence that social networks can have on the actions of an individual, the system facilitates the sharing and comparison of this activity data between peers. The system could be carried around in a non-intrusive manner, requiring little or no extra equipment for the users. Minimal user intervention is required in order for it to function effectively since the system tracks the activity of the user without direct manual input.

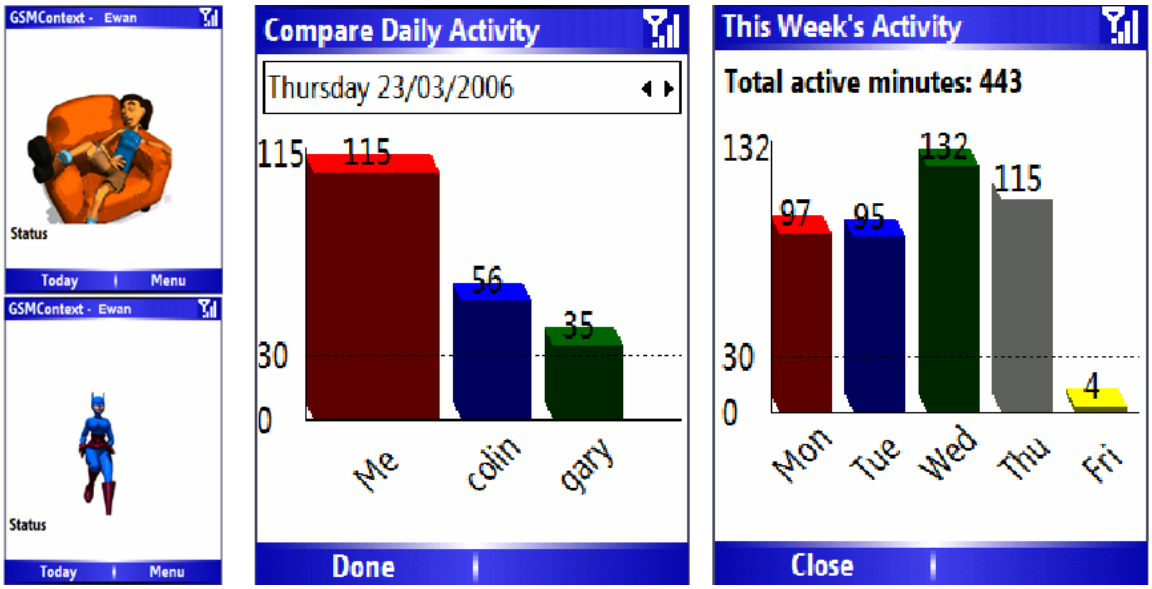

Figure 16: Shakra interface. Left: Two screens showing the users current activity—sitting still or walking. Middle: Comparing one's own activity to others. Left: An individuals weekly activity.

The application shows the current mobility state: no movement ('stationary') (see Figure 16 top left), moderate activity ('walking') (see Figure 16 bottom left) and travelling in a car, bus or train (collectively labelled here as 'driving'). The moderate activity is then used to display *minutes of activity per day*, with a historical view supporting comparison of activity across the previous week (see Figure 16 right) This supports user in monitoring their activity and exercise levels, with the exception that 'stationary' exercise (such as working out at a gym) is not tracked. A user can also compare their daily activity against that of their peers (see Figure 16 top middle).

When running the application for the first time, the user is prompted to provide a name—used to identify him or her within the system and to other users. The application records up to seven visible GSM cells and their signal strengths, every second. The current activity of the user is then classified every 30 seconds by the application's neural network, as described in more detail below. Using a web service, each phone uploads the recorded activity of the user via GPRS and stores it on a MySQL database, while simultaneously downloading information about other participants for later review. The system updates this shared information automatically every hour. If a user does not want to wait for an update, he or she can manually synchronise via the *Sync* menu option. Users specify in advance the peers they wish to share results with but, at any time, they can change the list of peers whom they wish to exchange information with.

A.5.2.1. Sensing Activity

The current activity of the user is inferred using patterns of fluctuation in GSM signal strength and changes to the IDs of detected cells. This method has been demonstrated as a reliable and unobtrusive way of sensing current activity [4], and has the advantage over the more traditional approach of using an external accelerometer in that it does not require additional sensor hardware as in Sensay [120] and the multi–modal sensor board of [93]. Rather like a traditional accelerometer, when a mobile phone is moved the levels and patterns of signal strength fluctuation change. For example, Figure 17 shows the total signal strength fluctuation across all monitored cells during successive 30-second time periods whilst walking, remaining still and travelling in a motorcar. The figure illustrates that it is relatively easy to distinguish between moving and remaining stationary but, at times, the pattern of fluctuation whilst walking will match that of driving and vice versa. This is due to the stop–start nature of both walking and travelling in a motorcar in urban areas. When driving, a greater geographical distance will typically be covered over a given time period when compared to that of running or walking. Therefore it is possible to use the rate of change of neighbouring cells to infer travel by car. To classify these patterns an artificial neural network is used. The network inputs are: the sum of signal strength fluctuation across all monitored cells and the number of distinct cells monitored over a given time interval. The network consists of a single layer of eight hidden neurons; weights are learnt using back propagation. The network outputs the currently sensed activity for the given input values. The network is trained by repeatedly presenting data collected during each method of movement. The current activity of the user is conditionally dependent upon their previous activity. In order to provide instant feedback to the user interface, the neural network deliberately does not model this behaviour. Instead, when determining if any

additional minutes have been earned, task knowledge is applied, based upon the output from the neural network over the previous two and a half minutes. This enables noise to be filtered out and a more accurate representation of the user's activities achieved. For example, periods of low signal strength fluctuation such as stopping at traffic lights whilst driving, can be ignored when placed between periods of high fluctuation, where many distinct neighbouring cells are monitored. It could be argued that activity would be more accurately inferred if a longer rolling filter had been applied to the GSM data. Introducing longer filters would have increased the likelihood of active minutes 'disappearing' from the users' activity totals. A decision was made that for the purpose of this study priority would be given to user experience.

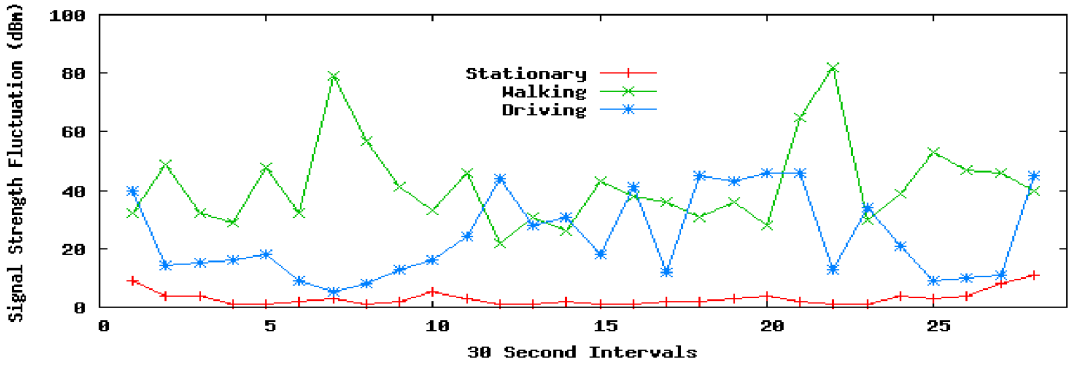

Figure 17: Activity tracking graph.

Before the trial, a base neural network had been constructed by using GSM data collected by the development team while sitting still, walking and driving. In order to determine whether or not further personalisation of the network was required for each of the trial participants, the system was given to each participant for a two-day training period. During this period, the participants were asked to record whenever their activity mode changed. This was a simple task supported in the application's main interface that users learned to do quickly. For the training days, the participants were asked to take the phones with them as they went about their normal activity. This trained the system for the areas in which they usually go throughout the course of a day. Following the initial system-training period, the data collected by the trial participants was analysed. It was found that only minor changes to the previously trained neural network were required by three of the nine volunteers. This was due to them living and working in urban areas that exhibited different levels of signal fluctuation to those where the initial training data had been collected by the research team.

A.5.2.2. Sensing in Use

Although previous tests had shown highly accurate determination of activity [4], the real test of the application would be using it in an uncontrolled environment among many different people. Overall, the participants of the Shakra trial felt that the application was very good at determining their activity and they found it very useful as a tool for measuring their activities.

After analysing the users' daily diaries and the information gained throughout the post–trial interviews, the logs of tracked activity were annotated on an activity time line. From this it was easy to see participants commute to work, break for lunch, and commute back from work. Two examples, with diary annotations, are shown in Figure 18.

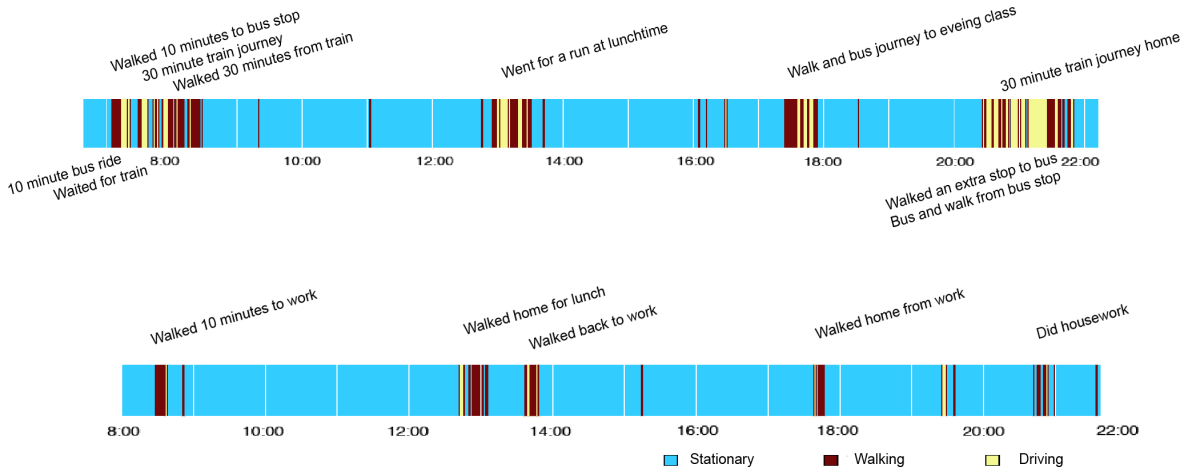

Figure 18: Activity lines constructed from logging and diary annotations.

Analysing the accuracy of the application was difficult as direct observation of the participants and their activity was not possible for any substantial length of time, and therefore could not be compared against the system's inference. However, the diary entries for three sample days from two different participants were picked to compare against the system logs. These were picked because the diary entries for these days and these particular users were particularly comprehensive. From the unfiltered data, short stretches of 60 to 90 minutes with varied activity were analysed. This was done to refrain from considering the long hours of inactivity that occurred during their workday, when participants were mostly sitting at their desks. Including this would have given unrealistically optimistic numbers. Results showed a minimum of 70% accuracy, during users' commute when fluctuations are highest. The misinterpretations often occurred during changes between different methods of transportation, such as getting off a bus or a train. However since there would often be a delay both before and after transportation, the

misinterpretations would cancel each other out, correcting the accumulated minutes of exercise. One more problematic finding was that running would occasionally register as driving. During one participant's 45-minute lunch run, 15 of the minutes were registered as driving. For another participant with a long commute, for example, it meant that he gained a maximum of seven active minutes each day due to error. These examples were the maximum errors found from looking at participants' commutes.

Some of the diary entries assisted in showing when still or walking activity was misidentified. For example, one woman from group 3 explained that she went on a walk for 30 minutes, but had only increased her overall activity count by 22 minutes when she returned. It should be noted that this particular participant lived in the countryside where the neural network would be less accurate, due to the decrease in density of GSM masts. Similarly, a male participant reported that his 10-minute walk to work sometimes only gave him 7 to 8 minutes of activity. This may, in part, be attributable to a lag in activity determination, as well as the participants stopping at road crossings. Since the application is aimed towards increasing awareness, rather than measuring physical exercise precisely, and it offers useably accurate overall measures, it is suggested that the small moment-by-moment lags and jitters in classification were not problematic for the purpose of the trial. Real-world reliability is, however, essential to enabling a broader range of applications, especially those involving moment–by–moment tracking and display. Since the pilot study took place, alternative methods of activity detection have been evaluated, and Ian Anderson has developed a new more promising substitute to the Artificial Neural Network based on Hidden Markov Models. Also, built-in accelerometers have become more common.

In order to share activity, Shakra uploads the minutes achieved by each player every 7 minutes. While uploading this information Shakra downloads the activities of the other users to enable comparisons to be made on the mobile device. To perform this synchronisation, Shakra stores the activity levels of each user on the local device, loading them into an XML dataset when the application is loaded up. This can then be synchronised with the server, running an SQL Server database, by exchanging compressed XML datasets over a standard GPRS connection. Since this data was small this was stored in the registry of the device and loaded up when the application began. While this was adequate for the size of trial being conducted, it would not scale well.

A.5.3. User Trial

There were three main topics that the study of Shakra aimed to explore. Firstly the trial was setup to explore how awareness systems can support behavioural change by providing users with a mechanism through which to reflect on their own activity. Secondly, the system was designed to consider the affects of peer involvement to behavioural change. Finally the study aimed to further explore the issue of self-presentation and how it can be supported by technology.

The trial of Shakra took place in three stages. First there was a period of 3 days in which the participants were asked to fill in a dairy noting their activity levels—they did not have any of our technology at this stage. The second phase saw them training the application on the phone, marking when they were still, walking or driving, for two days. This enabled the system to be calibrated specifically for each individual. Finally, the users were asked to use the system for a week, with it tracking their activity, making it available to them to see how much they were doing, and allowing that information to be shared amongst others in the group. The main Shakra trial was conducted over a week, with three groups of participants. In order to rigorously assess the long-term changes in users' behaviour and health, a much longer trial would be required. However, the week long trial served as a pilot of a potentially powerful activity promoting application.

A.5.3.1. The Method

After the study, the system logs were analysed. First of all, the activity times were compared to the self-reported diaries and the interviews, to make sure there was a fair level of accuracy in measuring activity (see A.5.2.2). Secondly, the logs were scrutinised to see how participants used the application, how often they compared their activity to others', and how often they looked at their weekly chart. The interviews were transcribed and categorised according to major topics and themes. The information was then used to elaborate on the users' reports written in their diaries. This included information such as precise times of commute, actual transport methods, and more detailed experiences and impressions of the application during the week.

A.5.3.2. The Users

The participants were recruited as groups of friends and/or co–workers who interacted with one another on a daily basis. The reason for this was so that sharing between peers could be evaluated and the issues that it raised studied and understood. In total, nine participants took part in the evaluation of Shakra, their ages ranged from 19-54. The participants were made up of three distinct groups, a married couple and two groups of work colleagues.

Their level of activity varied from inactive to very active. The participants contained 5 female and 4 male users, from a range of different occupations.

	Group 1	Group 2	Group 3
N	2	3	4
Age range	52-54	28-30	19-37
Activity Level	Female/Male	Male	Female
Occupation	Teacher and administrator	Technical administrators	Manger, administrative staff and student

Table 7: Shakra users

A.5.4. Findings

Participants took a phone with them every day, carrying it around with them wherever they went. They reported that the application was fun to use and gave them good—and sometimes surprising—awareness of their activity level. Two participants (from group 2 and 3) reported it to be highly 'addictive', in particular the sharing aspect. Another participant repeatedly explained how it made him see how 'lazy' he was In general, all of the users enjoyed sharing their activity levels with the other members of their group. Group 2, in particular, turned the experience into a competition, teasing one another whenever a high activity level was recorded. The individuals in groups 1 and 3 were much more supportive, encouraging, and, on occasions, going out with one another to increase their activity levels. Both, cooperation and competition were key factors in motivating the users of Shakra into increasing their levels of activities. This can be seen in how often the individuals compared their scores to others'. Group 2, being the most competitive, compared their scores most extensively, checking between 11 and 34 times a day. While groups 1 and 3 worked more collaboratively, they also compared themselves to others frequently, checking between 1 and 20 times a day. Although only four of the nine participants reported doing more activity than usual in the interviews, the diaries show that the other participants were also more active. Comparing each user's initial three-day diary, filled in before they received the application, with those used during the study showed this. They attributed this increase in activity to the application's sharing functionality as well as more general competitiveness.

A.5.4.1. Self-reflection

People often have an idealised notion of self that they try to adhere to, and they present themselves accordingly. This idealised self is very important in self-presentation as it guides what is shown to the audience (see 2.3.2). Throughout our everyday lives, we are continuously adapting our opinion of what our idealised self should be. This adaptation is often facilitated by mass media where, for example, images of footballers and models are continuously being touted as the idealised human form. Similarly, fashion and political views are influenced by the mass media. Whilst peoples' opinions change over time, their own notion of self maybe left behind languishing in their youth when weight or fitness was not an issue. This can result in people becoming detached from what they think they can do and what their actual capabilities are. For example, individuals often feel that they can play football for ninety minutes or run the next marathon because they have done it before, even if that was several years before. Whilst this is common, it should not be thought that people are lying (see 2.1.2). Instead people are reluctant to admit to themselves that they are no longer as fit as they once were. Two users of Shakra were taken by surprise when confronted with the actual amount of exercise they were doing compared to what they thought they did. However, those who knew them well were not surprised at all.

> *"I was speaking to my sister and I said I thought I was more active than that and she said: "come on, who are you trying to fool" ... it did make me a bit... if football hadn't been on [TV], I would have done some more. It shows me as quite a couch potato."*

The other stated,

> *"It probably made me more aware of how much I activity I do, in relation to walking, or how little I do!"*

In this regard, Shakra provided its users with a means for self-reflection and forced them to re-evaluate their idealised notion of self as opposed to their actual self. By being confronted with this information users were encouraged to do more activity to bring their actual self more into conjunction with their idealised self. This re-evaluation and adaptation of self is not uncommon in society. We are continuously being presented with new imagery, opinions and texts that force us to consider and adapt our own views. Through self-presentation we are continuously exposing these views and opening them up to public scrutiny. Context and setting are extremely important in how our presentation is

received by the audience (see A.6.4.2). Whilst we may feel that we are portraying a particular stance though our manner, attire and other communication channels, others' interpretation of these actions may not be as we had intended. In this way, our relationships with others drive the re-evaluation and adaptation of not only our self-concept, but also how we choose to present it. The importance of Shakra in this re-evaluation and adaptation was clear, with many users reporting that they were surprised by the gulf between what they had actually been doing and what they thought they had been doing. This awareness worked positively in encouraging the trial participants to increase their own activity levels.

> *"Well, I wanted to do more, but obviously we were at work, we are quite busy, me and Gary tend to be quite busy. Whereas Ewan he is up and about all the time, so… but it has made me realize … I think there was one night where I went home and I just started doing stuff around the house."*

As we are continuously, consciously or unconsciously, changing our views and understanding of the world through our social interaction, it is important to remember that this understanding is completely subjective and dependent on each individual's own interpretation [117]. For example, what does it mean to be 'fit' or 'unfit'? For a professional footballer to be fit is different from what it is to be fit if you are an office worker. In Shakra, the process of self-evaluation, whilst aided with the technology, did not rely on automatic categorisation of the activity data logged—as fit or unfit. Instead, Shakra relied on the ability to share and compare logged activity with others within the same social network.

A.5.4.1.1. Competition and Collaboration

By enabling users to share their exercise information, competition and collaboration became key to their continued motivation. This is something very common when training. Many people will have 'buddies' who provide them with competition or support when training in the gym, for example. Body builders, athletes and football players are just a handful of examples for whom exercise is motivated through competition. This can be seen in the following report.

> *"Ewan had a habit of doing extra walking you know, he was walking everywhere and we were like: wait a minute, you just make us look bad! This is not your normal activity."*

Competition is not only restricted to physical activity, it is one of the key motivating factors behind exclusivity of goods. The positional economy is extremely important as it gives individuals the sense of importance or of being special within their social groups. Therefore, whilst Armani or Versace clothes, Ferrari cars and (perhaps) Marks and Spencer's food, may all be seen as traditional and tangible positional goods, talent in art or sport can be used with equal effect to position oneself within society. However, as this previous extract shows, this must be done in a balanced way, otherwise the kudos associated with exclusivity can be lost. In extreme cases, this can lead to the exclusive party being pushed to the edge of the group.

> *"Me and Gary was kind of competing because Ewan was so [far ahead], he was the winner. He just wanted to win so much. Before we could even get it to a certain level, he was flying. Me and Gary would sort of check more often to see. Ewan just rubbed it in front of our noses, how far he went."*

This particular player states how another took the competitive aspect too far, which therefore meant he was effectively out of the game. While collaboration had been built into Shakra through the sharing feature, the emergence of competition and the playful nature of the use of the system facilitated the users in not only reflecting on their own activity levels, but also provided the motivation to increase it to compete with their friends and colleagues.

A.5.4.2. Self-Presentation

Since Shakra used cell towers to monitor movement this 'stationary' exercise could not be captured, therefore creating an imbalance between those who exercised outside and those who choose to exercise in the gym. One user suggested that if he was more self–conscious of his own body image, as is the case with many overweight people, it might become a problem. However, as this particular person stated he was secure in his own body, thus inaccuracy did not affect him.

> *"Yes, [the system did under estimated the amount of activity I did], ... the way I look at it would be that you can walk for half an hour but then again if you go on the treadmill for an hour you probably get more exercise. In that sense I don't think it represent the whole picture of how much exercise you actually do… [This] didn't really bother me. I suppose that is for myself, I am not that conscious of how people see how much exercise I do. I suppose thought, if I was overweight or whatever, I might have had an issue, but it doesn't really bother me that much".*

While some felt the system accurately reflected how much exercise they had done throughout the week, others noted constraints that meant they were not as active as they normally would have been.

> *"[I felt that the system represented my activity but] usually I am a more active. The fact that we are busy with the opening of a new centre [meant I wasn't as able to exercise as much as normal]… but it represents what I did over the last week."*

Without having a more global view of her activity and current context, this person expressed concern that others may have seen her to be lazy, when in fact she was not. This highlights the issue raised in Section 2.1.2 and was something that most of the users commented on, with varying degrees of concern—especially since the application was used between three separate groups of individuals who did not know one another. This will be discussed further in the following section.

While the system was able to determine activity levels from individuals' movements, some participants also noted that the activity levels achieved reflected the roles within their group. Group 2 in particular noted that one of its members—who was in charge of the team the other two were assigned to at work—was able to get up during the day and walk about when the others had to remain by their desks. The competitive aspect of the game opened opportunities for banter, and when this individual took advantage of his seniority he would 'rub it in':

> *"Ewan just rubbed it in front of our noses, how far he went. (Laugh) [He teased us] all the time! I mean, we would be sitting in calls and he would be walking by Holding up the phone [showing how much activity he had done]. Maybe if there was a meeting [at one] side of the building, he would walk [the long way] around the building to get there."*

> *"I think it is about motivation as well as 'be the best' development, because with those two guys, I want to wind them up about it. But, I think I suppose it is the same as when you first get SMS or you first get something and you want to do it, you just use it all the time. If I was following a training program [talks about how he would*

use it for training] if I could use the data to show I was following the training regime."

In Treasure, Castles, and Yoshi, similar game–appropriate behaviour was also exhibited. Using his phone, this individual was able to reveal his activity and use it to tease the other players. Those who were misrepresented were not able to reveal or show additional information that might have explained their low activity ratings.

A.5.4.3. Privacy

Presenting inaccurate or incomplete information in this way can be very harmful to the public face presented by an individual especially when a stranger, who has no other information to go on, sees the information. Most users did not feel this to be an issue as they were sharing their activity with friends and some even felt that the ambiguous nature of the data prevented people from interpreting the data in a way that would be problematic to them:

"I suppose that just because it is registered the fact you are moving, it does say anything about where you are or anything. No not really. It wasn't that bad at all."

However, other users were able glean information from this raw data. Some participants even highlighted how they were able to track what others were doing. This was possible through the use of the system and understanding of particular circumstances of the tracked individual.

"I was checking it in the morning before I went out to see of any of them were up before me… Then I would know if Gary was away to work or if he was away for his lunch, cause it would pick it up. I would [see], Gary [has] like ten minutes this morning and if [that goes up to] thirteen or fourteen I knew he would be on his way back from lunch and things like that … So yeah, you can track them."

This did concern one individual since he was taking part in the trial with his boss:

"The only thing was that I didn't get home till about half past twelve last night. So I clicked into the next day. So I had no way of seeing … they know what time I was getting in at …[if there were people you didn't know], you could see how it may be [used against you]."

These concerns led many participants to suggest that any future developments enable users to choose who can see what information, even if they choose not to use it. As here, it is often not just that people worry about keeping information private. It is also about understanding how that information might be used against them [8]. However, while privacy mechanisms were not explicitly implemented, social norms (discussed in 2.1) were important in mediating who actually looked at what information, regardless of whether they could or not. For example, in everyday life, people know to knock when an office door is closed or avert their eyes, often as part of a performance, e.g. when a person enters a password or PIN number. We are also often forced to avert our eyes from passers–by, to actively show we are not staring and invading their private space; this is something Goffman refers to as civil inattention

A.5.5. Discussion

The focus in Shakra was to move aware from games to look at awareness applications in order to study how to support behavioural change and understand the issues of impression management in this new domain. However, the use of the system became playful and some participants explicitly turned it, into a game to be played amongst friends. The competitive play that emerged motivated the users into increasing their daily activity levels if only to keep up with their fellow participants. Those who saw the tool as more of a collaborative system to be used in encouraging others when they were close to achieving their daily goal were often surprised by the amount of activity they and their fellow users were getting. This reflection, more often than not, revealed how little exercise the participants were getting on a daily bases.

Reflection is an important part of supporting behavioural change. By providing reflective material individuals are able to confront their idealised notion of self, which is often not representative of their actual self. Shakra facilitate reflection in several different ways, firstly it supported self-reflection by recording and displaying an individual's own activity back to him or her. When presented with this information some users were surprised at how little exercise they got and sometimes questioned whether the system was correct. However, in these instances the system acted as a valuable conversational resource around which close family and friends were consulted. In these occasions the systems evaluation was confirmed and the users were forced to revaluate how they saw themselves. Shakra also supported a shared understanding of what it was to be fit through direct compression. The users could compare how active they were based on their peers and how active they

were. This meant that those wishing to aspire to the same levels of activity as those in their close peer group new how much activity they had to gain.

Reflection, especially in impression management must be supported by appropriate feedback mechanisms, especially when a presenter is reflecting on a performance given to an audience. When these are not present concerns over privacy become apparent since misrepresentations might be made. In Shakra users were concerned over strangers being able to see their activity information. They feared that they might be seen as lazy, or that someone might be able to infer from their activity levels what they had been doing. In fact, one user who was a colleague of two others, one of whom was her boss, was extremely concerned that he might be able to infer that she had been out drinking one night when she had work the next day. This shows how individuals through of different ways in which the recorded information might be used and how that made them concerned about revealing it.

A.5.6. Concussion

This section has presented Shakra an awareness system designed to increase individuals' awareness of their own daily activity levels. The system was designed to explore, the involvement of peers in supporting behavioural change. The system was also designed to investigate how collaborative ubicomp systems are used in impression management. In particular Shakra was setup to explore two areas, self-reflection, and self-presentation. This was done through the tracking, recording and comparing of activity data amongst several different peer groups.

Shakra has shown several different ways in which peers facilitate behavioural change, through collaboration, competition, and also as reflective material that enable one to see oneself as one really is rather than as the idealised self one holds. To support this the system provided tools for direct comparisons of ones own activity over time, and comparisons against other users. When designing to support impression management designers must therefore provide these tools in their systems to enable individuals to face confront their idealised notion of self more often especially when trying to support behavioural change.

This section has reiterated the need for appropriate privacy and control mechanisms. Being able to control how one is presented is imperative if misrepresentations are to be minimised. Designers must recognise that systems themselves may inadvertently

misrepresent their users through inaccuracy or lack of a historical view of the current context.

In summary, we offer the following lessons or guidelines from this section:

- Support self-reflection, direct comparison
- Enable the construction of a presentation of self combining explicit user generated content and tracked information
- Appropriate feedback and control mechanisms must be in place to enable users to manage the impressions they give to minimise the risk of misrepresentation or un wanted tracking.

A.6. Connecto

A.6.1. Introduction

Connecto is a mobile phone application that displays context and location information amongst small groups of friends. The aim of Connecto was to understand how location awareness would work within a peer-group of friends. While the system shares much with earlier location tracking systems, Connecto is distinctive in that it continually tracks and shares location Thus, users need only turn their phones on to have their locations tracked and see their friends' locations. Like Shakra, Connecto used GSM signal strength, however, instead of using it to determine an individual's activity level it was used to mark locations.

Recent years have seen several commercial applications that share location between members of a social group, such as loopt[28], Mologogo[29], and Disney Family Locator[30]. However, there have been many factors that have impacted the adoption of these systems including privacy concerns, as seen in Shakra (see A.5.4.3), technical issues, cost and more general usability issues with the technology.

Location and user tracking are prevalent areas of research in ubicomp [18]. An early example is the Active Badge system [133], originally concerned with how the capture of real-time location information could support work within office buildings [77]. In the early chapters of this thesis, two systems were described that make use of location: George Square, designed for tourists, and Treasure, a location–based outdoor multiplayer game. There are also some online applications that let users 'microblog' status messages on social networking websites, such as Twitter and Facebook [85]. However, while these enable users to upload their own content, they do not adapt and change what is presented to the audience, as will be discussed in Chapter 7. This section of the thesis will focus on the technology used in developing Connecto as well as its user trial.

A.6.2. System Overview

[28] http://loopt.com

[29] http://www.mologogo.com

[30] http://disneymobile.go.com.

The system supports the sharing of three types of information: location as tracked by the phone itself or manually specified, the time spent at the current location or how long it has been since the user has left a known location, and the current ring profile (see Figure 19 left). All of this information is shown on the mobile phone's contact list, which can also be used to call or send text messages to the other participants. The system was also able to detect incoming and outgoing calls, and text messages. The participants were made aware of this, and told that none of the content would be recorded; only the action of making/receiving a call or an SMS, and the recipient/sender, would be recorded. This information was then used to create dynamic questions in an online usage diary, as described in A.5.

A.6.2.1. Sensing Location

Connecto was designed for Windows Smartphones and implemented in C#, which executes on the .NET Compact Framework. Using the .NET Framework provided access to the mobile phone ring profile as well as the ability to 'hook into' incoming and outgoing SMSs and calls. Therefore sharing ring profile and logging the communication between participants was made easier. The profiles available, by default are, *normal, outdoor, vibrate, silent, car, automatic, speakerphone* and *headset*. For example, profiles may be *normal*, in which the phone rings audibly. In *vibrate* the phone is silent but vibrates. In *silent*, the phone does not audibly ring or vibrate when a call is incoming. However, as will be detailed later, these profiles were modified and new ones added, so that users could better express their current context.

Whenever the user changes the phone's profile, Connecto instantly detects this. Connecto also used RF fingerprinting to provide location information. RF fingerprinting techniques rely on the situated nature of RF beacons, such as GSM cell antennae or 802.11 access points. Through detection of the unique IDs and signal strength levels, a unique pattern or 'fingerprint' that characterises a particular location can be generated. Once a location has been fingerprinted, the application continues to scan, comparing the current scan (or a sequence of scans aggregated) to stored fingerprints, to determine if any have a significant enough match, therefore ascertaining if the device is at a known location. A match is determined when at least 60% of the cell IDs and strengths currently detected align with one of the stored fingerprints. If there are multiple fingerprints that meet this requirement, then the one that has the greatest overlap with that currently detected is selected to be the location the user is currently in.

A similar system that employed GSM fingerprinting is ContextPhone [110], which also provides a shared awareness of locations between groups of friends The Feeding Yoshi game presented in A.3 also employed a version of WiFi fingerprinting, albeit a simplified one that relied on matching on only a single access point, rather than multiple access points and their signal strengths. GSM fingerprinting techniques of this style have been shown to have an accuracy of 94 meters at best, and in poor circumstances this may drop to 277 meters or lower [28]. However, this technique was more than adequate for Connecto, as its intended use was with a small set of relatively low granularity locations, such as 'work', 'home', 'gym' and 'cinema'. This tolerance was found to be useful enough, and it contributed to the possible 'vagueness' of the location.

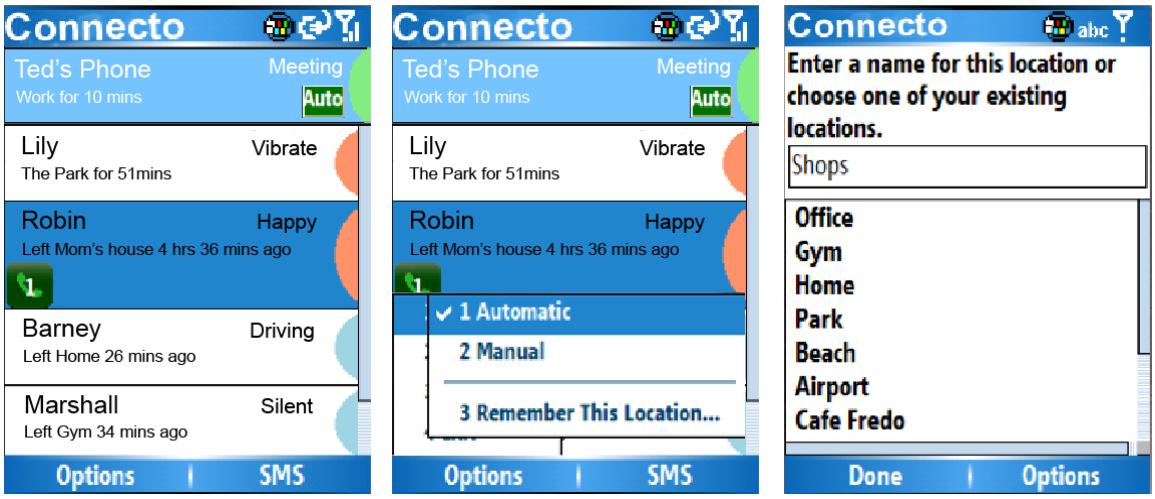

Figure 19: Connecto interface. Left: 'Ted's phone' showing the current location and ring profile he is sharing with others. This also shows the other people in his contact list and their current status. Middle: Automatic location tracking (1), Manual entry for current location (2) and marking a location to be used to automatically displayed when a user is there (3). Right: Entering a new location.

A.6.2.2. Sharing Awareness

When Connecto is first installed on a phone, there are no locations in the database. However, users are able to mark any locations they desire, tagging each one with a text identifier that can be displayed as their current location simply by selecting the 'Remember this location' command from the menu (see Figure 19 middle). They are then asked to label the location with a short (less than 20 characters) identifier that fits on one line (see Figure 19 right). In order to ease the initial start up for users some preset locations that could be tagged we provided, such as home and work to eliminate the typing time. Training then commences: every five seconds for the next minute, the application records all the cell antenna identifiers and signal strengths it can detect. When the training is complete, the result is stored in the database: a mapping between the chosen tag and the

cells' identifiers and signal strengths. Due to the situated nature of 802.11 beacons, whenever the device returns to that location the same (significantly similar) fingerprint will be detected and the system will display the given tag. If at any point, the user notices that the application does not correctly recognise the current location, he/she can 'retrain' that location. This simply initiates an additional minute's training, merging the results with those from any previous training. While locations could be marked and automatically tracked in this way, the players could also specify where they were manually (see Figure 19 middle). This was intended to address any privacy concerns that might have arisen when sharing this information with others

All of this information collected by Connecto, including location, phone profile, calls, and SMSs made and received, is uploaded to a central server every 7 minutes.. At this time Connecto also downloads updates from the other users currently in the user's contact list. To perform these synchronisations, Connecto maintains a database locally, and synchronises with an SQL Server database, running on a server, by exchanging compressed XML datasets over standard GPRS connections. This process allows Connecto to update the information it displays at least every 7 minutes, at minimal cost in terms of network traffic and battery life.

A.6.3. User Trial

The study of Connecto was designed to explore two main topics. Firstly it was designed to further explore how individuals integrate technology into their everyday lives. Secondly, the system was setup to explore how shared awareness of others activity affected the interactions between individuals within a peer-group of friends. More specifically the system was designed to explore how individuals used awareness of others location to coordinate their activities both individually and as part of the group.

The Connecto trial ran for two weeks, ensuring that users had time to learn how to use the system and how to accommodate and appropriate the system in a way that best suited their everyday activities. It was also hoped that a more prolonged period of use would mean that participants would get past the 'novelty' factor of a new application that can bias users' opinions Connecto provided several insights into how individuals managed and shared their on going activity but it also highlighted some previously well know techniques important to impression management such as recipient design and expression. However, the unique nature of the experience resulted in some nuanced insights into some more subtitle impression management.

A.6.3.1. The Method

Employing similar methods to those used in other studies of mobile technology, including Shakra, such as fill-in diaries [6] and interviews [83], the aim was to gain insight into usage patterns, behaviour and feelings that the participants had towards sharing information using Connecto. One challenge was to gain this insight without intruding or making constant enquiries that can influence behaviour. Therefore, a dynamic diary tool called Flexifill was used for daily enquiries. The Flexifill diary automatically constructed questions based around the users' activities with the phone, such as the incoming and outgoing calls they made that day, and text messages they sent. Participants were asked to fill in the diary every day, at their convenience. Over the two-week period the participants were also interviewed twice: first after a week, then at the end of the study. The system was also extensively logged, including records of calls between the group members, text messages (stripped of content for anonymity), as well as the participants' profile and locations. The particular mode (manual or automatic) in which they chose to specify their location was also logged. The participants were all informed, before the trial began, that this information would be recorded, and were assured that data would be processed anonymously. After gathering the data and transcribing the interviews, they were divided into distinct themes for analysis. The focus was particularly on how users managed their self-presentation through location and activity naming, and the social dynamics within the group. The study also looked at how the participants used the manual location setting.

A.6.3.2. The Users

Two close-knit groups that lived, worked and studied with one another were recruited for the study. Group 1 consisted of six young professionals and graduate students in their early twenties, four of whom knew each other from an activity club, and two partners of members of that four (the partners were well acquainted with the rest of the group). Alongside two (non-computer science) students, this group represented a range of occupations. In contrast, Group 2 was a set of five close colleagues in their early thirties who also socialised outside of their work in a large technology company. They were employed within two different teams and had different roles, but worked in the same building. Two of these participants commuted together to and from work on most days.

Teams	Females	Males	Age range
Group1	2	4	22-26

Group2	0	5	30-33

Table 8: Connecto users.

A.6.4. Findings

Throughout the trial, players regularly used the system to express aspects of their current activity to other players using many different types of information. This included location, specified automatically and manually, and phone profile. They also used these features to co-ordinate their activities with one another, such as where they should meet.

There were several significant events that occurred during the trial. These included a shooting trip that the male members of Group1 went on, a football match that became the centre of conversation between Group2, and a car crash involving one of the members of Group1. It is important to note this incident was not caused as a result of Connecto. However, the participant used it to inform all of his friends using the system and letting them know that he was alright. In addition to this, several of them then phoned him to make sure. While these events had huge significance, there were also small events that encouraged similar notification and co-ordination with others that will be discussed later.

In their day-to-day use of Connecto, users were able to co-ordinate and communicate with other members of their social group using the system, but they also used it in an expressive way. Users would carefully craft what they shared, to convey aspects of their current activity and location based on their ongoing experiences. These stories or personal narratives took into account commonly understood meanings and historical contexts of use that the individuals within the same groups shared. Impression management was an important issue when crafting these stories. Individuals would explicitly highlight activity that they felt would show them in a good light. The remainder of this section will discuss these issues further, focusing in particular on how the users appropriated the system to support a variety of different uses.

A.6.4.1. Co-ordination and communication

Connecto was used for a host of different tasks. One of these was the co-ordination of calls. By checking the ringing status of another person before making a call, one was able to determine whether or not it was a good time to disrupt that person. Some participants deliberately did not call a friend after noticing that he/she had set his/her profile to silent. One participant described such a situation,

> *"[I]f his profile was set to silent I would text him and if it [wasn't] set to silent but he [was] at [University] I [wouldn't] text him, so that was quite useful, [avoiding] those ring tones in the middle of lectures."*

Often users would simply delay the calls, however, in this situation, with a variety of different communication methods available, the individual chose to send an SMS instead. This behaviour was also reported by several of the other participants, and highlights the importance of having different communication medium in co-ordinating activity. However, this is also important when trying to maintain public and private personae, as will be shown in Chapter 7.

The two different types of information, location and ring profile, that were shared also helped participants co-ordinate everyday activities. For instance, two of the trial participants lived together, one of which was particularly enthused about being able to see when his flatmate was home. He used this information to send a text message asking the flatmate to *'take tonight's dinner out of the freezer'*. Participants not only found knowing where their friends were useful, they were also able to infer from this, coupled with their in-depth knowledge of the other members, what they were 'up to', as in Castles and Shakra. In one eloquent example, a participant explained that by revealing his location the other members of the group were able to infer that he was 'taking care of picking up supplies'. The members of Group 1 were going on a trip, clay pigeon shooting, and he was assigned the task of picking up the supplies for the trip:

> *"Oliver got the phone the other day, and he knew because of my location that I was up at where we shoot clays so he knew I was going to be buying the ammunition … I spoke to him later on 'cause I had to take some stuff around. I said to him in the evening 'I bought the ammunition' and he was like 'yeah, I know, I saw your location' and I was like 'oh yeah, right', so that's how I found out he was using the system"*

After calling his friends later that night to notify them that he had picked the supplies up, one noted that he already knew as he had seen that he was at the shooting range and therefore must have been picking up the supplies. This meant he did not have to phone and remind him earlier in the day. Similar incidents happened with the two couples. Both reported episodes where one asked his/her partner to pick up something on their way home

after seeing that they had just left university or work. This awareness of one another's activity also proved to be a valuable resource in co-ordinating group gatherings. The shooting trip mentioned above was an excellent example of this. Another participant who commuted to work in the morning with a colleague reported that it was useful for him to be able to see when his colleague had left the house. He could then rely on him picking him up about twenty minutes later. He reported and mentioned a particular occasion where this came in useful.

> *"I have been travelling in with John ... in the mornings, and sometimes in the afternoon ... so I could actually check to see if he had actually left the house yet to get picked up. One morning when I was waiting on him and it was still saying home and I phoned him and he had slept in. "*

Since this individual knew when his colleague should have left the house, using Connecto he was able to notice that there was a problem and contact him. So far, we have looked at how location and profile settings were used to co-ordinate and communicate with others. The next section will discuss how naming these locations and profile settings supported this.

A.6.4.2. Profile and Location Naming

During the trial, participants defined between 6 and 20 locations on the phone over the two weeks and, on average, they created 10 locations each, with approximately 20% of the locations set manually. The players also added, on average, 3 profiles each that could be used, in addition to the mobile phone's default profiles (*normal, meeting, outdoor* and *silent*). These profile names were often expressive and playful. Labels were either variations of the built-in names such as 'Shhhh…', activities such as 'Studying' or just expressions such as 'Fine and Dandy'. Others were a little more risqué for example, 'Horny'. These types of names were often created to get a reaction from the other participants, which they often did.

The names given to locations throughout the trial varied in type. When examining the log data, four different types of location labels can be seen:

1. Labels of geographical reference,
2. Place names that describe a location in terms of personal meaning,
3. Names of locations that describe an activity,

4. Hybrids.

Geographic labels	Place names	Activities	Hybrids/expressions
M6	In-laws	Shopping	[City] stuck in traffic
Radnor Street	Sainsburys	Parking car	Tax lecture in j watt
Blackpool	Gym	Car crash	Crap lecture
Airpoirt	Restaurant	Clays shooting	Johns car to work
Tormore	Library	Away for a run	M6 northbound
Amsterdam	Mums house	Drinking	Bed, sleeping, drunk
Charing cross	Shopping	On the job	Manchester Meeting
25	**50**	**11**	**18**

Table 9: Categories of location labels used in Connecto.

Geographical labels were most often used when participants were travelling, or in a place that was out of the ordinary for them. For example, one participant used this type of label in order to display where he was each day during a holiday. Place names were names that made sense mainly to the people in the group, but were not further defined. For example, one participant explained why she set one location to the very general term of 'restaurant' one Friday evening:

> *"Well probably I put 'restaurant' thinking to myself, [my partner] knows I am in [town name]. So I put restaurant in. But if he did want to phone me and I didn't answer he would know it was because I was in a restaurant and I probably didn't go into much detail because I felt well, the only person that is gonna look at this in the interest […] of wanting to phone me is gonna be [my partner]. He knows I'm in [town], he doesn't need to know which restaurant I am in."*

She went on to elaborate:

> *"[I]t was just to let him know I wasn't just sitting at home twiddling my thumbs."*

So, while this tag was designed to be deliberately vague, it was also designed to show that she was having a good time even though he wasn't there. Importantly, this shows her as a sociable and independent individual, as discussed further below. As has been shown in A.6.4.1 careful crafting of tags was not unusual. However, while Connecto was primarily designed as a location sharing service, some also used it to show the activities they were doing. The strong link that often exists between activity and place made it sensible for the participants to use such labels in certain situations. One participant for example explained how he viewed 'parking the car' as a useful label:

> *"I thought that if [my girlfriend] was actually in the flat she could see that I am parking the car. I have to park ten minutes from here, you know. ... [Then she knows] I have left work for a start [...] then I am parking the car, then I am in Radnor Street, then I am home."*

The final type of label was hybrids, i.e. the labels that use more than one type such as augmented places, for example 'home carlisle', used by one participant who went home to her parents for a few days. It felt like home to her, but in order not to confuse her friends, she added the place name to express that it was 'the other home'. Another example was places augmented with activity, for example 'Tax lecture in j watt'31. The participant wanted to express that not only was he in a certain building, he was also at a specific lecture.

A.6.4.2.1. Manual vs Automatic

Manual mode was included to support the users in hiding where they were, if they did not want to be found, or they did not want to reveal what they were currently doing. In a pre-study questionnaire, participants expressed that they could imagine using a manual setting when at the doctor's surgery or when arranging a surprise—for example, buying birthday presents. However, in the post-trial interview none of the participants said that they used the manual setting for privacy protection. Instead, they found the manual setting useful for 'freezing' a location. For example, three participants set their location to manual about once per day. One of them worked in a large area and found the automatically determined location imprecise, and so manually set the location to 'work' to overcome the limitations of the system The second participant reported that she felt it was easier when she was on the road to just set it to 'M6' (a motorway through Britain). The third participant encountered the same problem when on a long drive; he explained in his diary

[31] 'James Watt Building' being a building at his university.

"[…] because I was travelling like 400 miles down south, the best option was to leave the phone and profile onto a certain arrangement so people would know where I was".

Although many studies show that people frequently lie and give incorrect information in social situations [34], there was little of this kind of deliberate deception found. Instead participants preferred to use vagueness and ambiguity in their location label to manage their location disclosure. The flexibility that the manual setting gave the participants was highly valued by about half of our participants. Six of the eleven participants used the manual setting during the two weeks of the study. For example, one female participant wrote in her diary on the second day of the study:

"[Yesterday] was the first day I'd used the phone and my initial reaction to the service was that it was a bit creepy knowing where people were, although today it was good fun to 'play' with the service […] and decipher how it worked. The fact I knew I didn't have to enter locations if I didn't want to or could set it manually made me feel more in control."

A.6.4.2.2. Recipient Design—Tailoring for the Audience

A subtle but interesting characteristic of the participants' use of the system was how they actively became aware of how others could now also see their location and profile (see Chapter 7). Previous literature on positioning systems has generally focused on the reading of place labels, but the Connecto participants also put effort into authoring their labels too This reflected their concerns for presenting themselves in certain ways (see 7.1.4.2). For example, one participant described how she wanted to demonstrate that when her boyfriend wasn't around she still had fun (see above). The user who crashed his car explicitly stated that he used the system to see the reaction of the other users to the news that he had been involved in an accident.

"I had a crash yesterday but it wasn't my fault though […] a transit van drove into the side of the car which is not very good. [I just put it on my profile] to see what everyone would say to get their reactions […] [One of the other users] text me and then he phoned me."

Another participant explained how he regularly updated his locations, to reflect where he was, one day when he was out shopping:

> *"Saturday I put in very specific [location] I just kind of thought, well you can put in shopping, shopping is very generic you know. You could be absolutely anywhere shopping. So I started put in more specific [names], I put in 'Next [High Street]', you know in brackets […] I just put wherever I was in. Ehm, 'Topman' as well. […] It's a bit like just letting everybody know where you were."*

Controlled self-presentation is, of course, not unique to digital systems (see 2.3). We all make sure we present ourselves in certain ways, and adapt our behaviour to both the location and the surrounding people [68]. What is perhaps unusual is that in Connecto, participants were self-conscious about what their profile and location was set to, even though they could never be sure anyone was actively watching. They chose the labels carefully rather than randomly, and they crafted them in such a way that as to be understood by their group of friends.

A.6.4.3. Sharing Information as Story telling

Connecto was primarily designed for the sharing of location, however the participants used the combination of location and the mobile phone ringing profile to communicate, in more detail, their current context. Often the location would be a place name and the profile would indicate an activity. One example was a male participant who set his location to *'the lane'* and his profile to *'drinking'*. The lane was a small street close to a university with bars, restaurants and shops. By personalising his profile he indicated that his friends were welcome to come along. Indeed, another participant reported that he had joined him later, after seeing this status. Other combinations were less dependent on each other, such as *'work'* (location) and *'boring meeting'* (profile) and *'home'* (location) and *'sick'* (profile). When asked why they set such a combination of indicators, one female participant said:

> *"It is like telling a tale, using both [location and profile status]".*

This 'story telling' was strongly supported by the system's flexibility in terms of location and profile naming. This 'story telling' was similar to that seen in Castles (see A.4.4.1.1), especially those who acted as commentators narrating play. This openness to interpretation was one of the keys to the success of Connecto. For example, participants overwhelmingly used generic terms such as 'gym' rather than saying exactly which gym. These vague place

names as well as the combination with profile naming were the essential glue for socialisation around the application. Not only were geographical names less relevant, often they were not telling enough of 'the story'.

Sometimes the stories would be 'broken' by problems in the technology. Understanding the broader social context enabled participants to overcome this in the same way that revealing the underlying infrastructure in Section A.2 also supported overcoming problems. For example, one participant reported noticing another's profile fleeting between 'the pub' and 'economics lecture' late one evening. He knew that the pub was very close to one of the lecture halls and was, therefore, able to interpret that this was simply a matter of the phone being *'confused'*. They both reported joking that the participant had been at a lecture late that night and early the next day. Another participant who car-shared with a work colleague reported having set the location to 'Johns car to work', only realising later that the phone would show the same location on the way back from work. He said in the interview that he thought it was fun and, although no one had commented on it, he did not change it on purpose as he expected his friends would know he was going back from work when it was the afternoon. These examples illustrate that the stories are not necessarily freestanding, and that most often needed interpretation in a broader social context, mainly by the friends themselves. If the friend had not known that the pub was close to the lecture room he might have thought the participant was (inexplicably) in a lecture at 11pm. Similarly, the other participant's friends would have thought he was working late. Since Connecto was designed for close friends, they seemed relaxed about the 'correctness' of the status. In fact, they quickly started using Connecto to express all kinds of situations, moods and experiences.

A.6.4.4. Awareness of the Activity of Others

Participants were initially very observant of each other's status. They reported checking the phone 'constantly', both in relation to their own status and others. When asked if she liked Connecto, one female participant said in the first interview:

> *"I always check everyone! Cause I wanna see what they are all up to. I'm just nosey [laugh]".*

Although the frequency of checking others' status slowly went down through the study, according to most participants they continuously enjoyed the awareness of their friends' activities the application provided them with throughout the day. However, this awareness

was two-fold; Connecto provided an awareness of other people's activities and whereabouts, but it also meant that participants were aware that others were aware of them (also see A.5.4.1).

Participants used the awareness of others' activities for both practical issues, as described above, and in more social pursuits, such as impromptu gatherings (see A.3). For example, one participant used Connecto specifically to show others that he was at the shooting club. In the interview he explained that he had hoped the others would come up and join him, and indeed two of them did. Another participant explained that he enjoyed observing that others were getting home later than him.

More frequently, however, the past days' labels would be used when friends and colleagues were together. Several participants mentioned how they would comment on previous locations and certain 'colourful' profile names:

> *"It does kind of make you chat more about what you are doing and that sort of thing. Seeing that you were at [restaurant name] on the weekend. Whereas other times you might just never really, well you might just be like 'how was your weekend?' and then not really say nothing. Whereas when you've seen they were at a certain location then that kind of gets you chatting."*

In this role, Connecto contributes to the ongoing thread of conversation between friends and the ways in which, in Sacks' words, "friends show that 'my mind is with you'" [115] – that they are paying attention to each others' lives and activity Here, mutual monitoring acts as a part of friendship relations by adding to the ongoing 'relationship state' between participants. This was not just that participants would draw upon others' past locations in conversation, but that they would be expected to have seen each others' location or they risked falling 'out of touch' with the group Just as we remember to whom we have told what stories, and mistakes can cause embarrassment, Connecto helped support knowing who was where, and when. This was the background knowledge of the routines and activities of the group.

A.6.5. Discussion

Connecto did not explicitly support reflection, however individuals' use of location and ring tone labels shows a subtle form of reflection. This involves seeing oneself as another might; this was carefully considered when designing labels for other users. Therefore, with

respect to RQ2, designers must make use of recorded information to enable these three types of reflection to be supported when designing for impression management.

In Connecto, misrepresentations were occasionally made since the information presented was not placed within its historical context by the system, and some occasional problems encountered with the technology. However, while this was the case, the ambiguity meant that such misrepresentations were explainable. With regard to RQ2 this is an important consideration for designers. While it might seem that system use should ideally be 'accurate' it must also provide some level of ambiguity so that any misrepresentations can be explainable to an audience. For this to work successfully though feedback about a presentation must be given in a timely fashion so that if needed an explanation can be given.

While we have seen the importance of ambiguity in being able to explain misrepresentations, ideally these misrepresentations can be minimised by incorporating everyday activity into the presentations one gives as well as using them to drive tailoring this information to the audience. With regard to RQ3 both Shakra and Connecto have introduced new ways of tracking activity using neural networks and hidden Markov Models and tracking location, using both GSM and WiFi fingerprinting techniques. This infrastructure has enabled the users of both Shakra and Connecto to incorporate their everyday activity into their presentations of self and also enabled them to reflect on their own self-image. This integration of everyday activity also enabled the users to narrate their lives, in a similar way to the players in Castles creating stories and commentaries to share their game. Therefore with regard to RQ2 and RQ3 designers must make use of such infrastructure to support this narrative construction so that individuals can confirm the presentations they make.

In Connecto an already established shared understanding was put to use, constructing private jokes and coordinating activity within the group. Since there is a connection between the people, places and artefacts that presenters use in constructing an appropriate presentation of self and the audience viewing the performance this confirmation can be done. Therefore, with respect to RQ2, designers should aim enable users to include these commonly understood artefacts, people, and locations so that they can be used to confirm and maintain a particular performance.

It is important to consider each of these methods and support each of them wherever possible. More generally, this chapter has highlighted the efforts to which individuals will go to make sure that any communication they make is designed appropriately for the audience viewing it. On occasions some players used outrageous labels to describe their feelings, however this was framed with the group it was being presented to in mind. In the following chapter, the author will show how ill–formed utterances can lead to retribution from the group. This recipient design echoes the requests made by users of the George Square blog, where they requested to have tools to tailor and craft the information from their visit. This chapter has also shown the importance of ambiguity, and the need for explicit control as well as implicit tracking. When explicit control is available, users feel more comfortable about giving out information, however implicit control is much less costly to the user in terms of his/her time. In this case, ambiguity can be used to help explain any misrepresentations. In some occasions, explicit control over the positions individuals were shown to be at was needed, not because of privacy concerns but to correct problems with the automatic tracking system.

A.6.6. Conclusions

In summary, we offer the following lessons or guidelines from this chapter (built on from shakra):

- Support self-reflection, direct comparison, and where possible give an outside perspective of oneself.
- Support ambiguity to make misrepresentations explainable
- Enable the construction of personal narratives by combining explicit user generated content and tracked information
- By enabling common artefacts to be used in self-presentation the audience can confirm if the presentation is genuine or not.

In the following chapter, the author will further explore tailored presentation based on the audience that is the recipient of the performance, as well as further exploring how everyday activity can be used to dynamically adapt asynchronous presentations.