

12 User Presence in Mobile Environments

Giorgio DA BORMIDA, Paul LEFRERE

Abstract: Three forms of mobile-supported user presence are discussed, in the context of an international project, MOBIlearn. These are:

- (1) ‘anticipatory’ user presence, meaning the kind of presence needed to prepare for a meeting or a visit;
- (2) ‘super-real’ presence, meaning ways of increasing one’s sense of participation or one’s apparent level of participation (as perceived by others) during a meeting or a visit, for example, the use of a combination of real and computer-generated images;
- (3) ‘retrospective’ presence, meaning being able to change the apparent nature of one’s presence, and perhaps even the level and nature of one’s participation, after the event.

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12.1 Introduction

This chapter is concerned with three forms of mobile-supported user presence, as facilitated by environments of the kinds being investigated in a multi-partner international project, MOBIlearn:

- anticipatory presence (e.g., to prepare for physical presence such as an important visit, or to prepare for a first meeting (face-to-face or virtual));
- super-real presence (e.g., during a visit, using computer-generated images to overlay real images, to augment your sense of being there, or to increase your visibility to other people who are also there, to make a visit more memorable);
- retrospective presence (e.g., recording the presence of people who were present at an event, and editing those records, to make it seem to you or to others that you had been present when you were not, or had participated in a different way, or were more visible than was the case).

Those forms of user presence require the use of images, sounds or data streams, managed in ways that take into account the facilities and devices available to a user at particular times and in particular places. Mobile devices may be used to provide information about the user's context, including location, and to deliver some or all of the images, sounds or data streams that support a particular form of presence.

The three forms of user presence considered here have the potential to be used to do more than create a personal illusion of presence. They offer the prospect of being able to create and share experiences that are "rich, coherent, replicable and extensible to other applications and domains" [1]. To do this, they require instrumented environments, able to support the necessary richer forms of interaction and data capture.

This is consistent with visions of high connectivity everywhere, supported by high levels of computational resources. This is captured in the term 'ambient intelligence', which may bring nearer the implementation of true 'anywhere, anytime learning'. In that sense, the MOBIlearn project complements and extends current thinking about presence, as captured in these quotations:

"Presence, the sense of 'being there', can be defined as the experience of projecting one's mind through media to other places, people and designed environments. This experience is supported by interactive systems that allow humans to escape the boundaries of space and time for purposes including communication, learning, entertainment, commerce and remote actions." [1]

"With the possibility of accessing the Internet anywhere and always from a wide variety of devices ranging from powerful multimedia desktop computers to tiny mobile devices, it becomes increasingly important to be able to control the 'visibility' of people and devices and to express their capabilities. 'Virtual and Persistent Presence' is the umbrella term that captures these issues." [2]

"Virtual and persistent presence provides the services needed to manage 'always being online'; it is about availability and capacities of both humans and resources. Typical information that should be available is 'Who else is looking at this page?', 'Can this device receive voice or video?' and 'May I disturb Jane at the moment?'" [3]

12.2 User presence as envisaged in the MOBIlearn project

The MOBIlearn research and development project [4], co-funded by the European Commission, and prospectively by DEST (AU) and NSF (USA), groups together more than twenty four partners from Europe, Israel, Switzerland, USA and Australia, to explore some of the educational possibilities of ‘ambient intelligence’ in a mobile environment.

Developing new forms of technology supported learning, relevant to individuals or small groups of people spread Europe-wide in many and various sites, may require support for new forms of presence. Key issues will be determined theoretically and empirically.

Trials of the MOBIlearn system will involve these representative groups:

- *Citizens as members of a culture*, to enhance their learning experience while visiting a cultural city and its museums;
- *Workers*, to meet their job requirements and to update their knowledge continually;
- *Citizens as family members*, to have simple medical information for everyday needs.

Users will be studied systematically in three application scenarios (see Table 12.1).

MOBIlearn includes studies of different approaches to implementing such scenarios. This means noting what people would need to carry around with them (‘bearable’ computing versus using ordinary laptop computers), looking at what they could be shown (e.g., augmented reality, worn interfaces) and studying what they could hear. Each of these has a bearing on the kinds of presence that can be supported.

In order to formalise this work and its findings, attention is being given to developing description techniques for the features of the underlying architecture; modelling non-functional requirements; tailoring and co-ordination mechanisms; mechanisms for traceability of non-functional requirements; and comprehensive evaluation criteria.

The general requirements of the MOBIlearn system, and the implications for which kinds of presence to support, will be extracted from the three scenarios to be used in the trials. A literature search will be conducted to identify suitable metrics for assessing cognitive load, with a view to setting a general requirement to minimise that load. This may involve looking at the methods, algorithms and practices people use to perform their tasks, and the resources associated with cognitive scaffolding available in the environment.

Also, surveys will be undertaken of relevant work in laboratories worldwide, on topics relevant to presence in mobile-enabled environments, such as using virtual proximity to make inferences about users [5].

12.3 Anticipatory presence

Following Bakalakos [1], we take presence to be the sense of ‘being there’. By extension, anticipatory presence is the sense of ‘being there’ before you get ‘there’.

Consider the case of one’s first encounter with a person or a place. We surmise that most people would prefer to have positive memories of such an encounter, and further that they would like the encounter to be facilitated and made more valuable than it otherwise would be. Few of us have that luxury, let alone the luxury of trial and error in managing one’s daily life choices, as explored in the film *Groundhog Day*.

Continuing at a general level of discussion, the importance that people often accord to preparing for their first meeting with someone is recognised in the old saying that “You only get one chance to make a first impression”. Some people spend more time preparing for a meeting than they spend in the physical meeting itself (e.g., [6]).

Table 12.1 MOBIlearn application scenarios

Scenario	Types of presence to be explored	Example
1. Museum visit, where learning citizens are enabled to access context sensitive art, historical & cultural knowledge with mobile devices	anticipatory presence	preparing people for the visit by providing some way for them to explore the location virtually, either via robot cameras or by access to samples of evocative and stimulating images and sounds ‘as seen and heard by visitors’
	super-real presence	annotating what people are looking at, via overlays on real-time images, so that their attention can be directed to particular things to notice
	retrospective presence	a personalised recording of your visit, which you can share with others
2. Master in Business Administration (MBA) schools use mobile networks and location-based systems to extend the reach and scope of their current blended-learning offering, and to provide learners with personalised and tailored access to content as well as support for planned and ad hoc interactions with other users	anticipatory presence	preparing for a work meeting or a study group by providing simulations of the environment expected for the discussion and the kinds of events that are typical of such meetings
	super-real presence	accessing information about the ‘flow’ of a (face-to-face or virtual) meeting, during the meeting, with the support of an agent (a software agent such as context-aware virtual assistants, or a human agent such as a mentor or observer); the agent can highlight the nature of interactions by enhancing or reducing the presence (‘aura’) of a given participant, or can annotate the objects in the room or the agenda items, to link them to current discussions or to data sources
	retrospective presence	recording the discussion flow and presence of people who participated at the event, and editing those records, to make the meeting seem more coherent
3. Access to basic medical knowledge to enable support for anywhere and anytime interventions	anticipatory presence	to prepare for the kinds of physical presence and realia that will arise in even simple medical emergencies, through games, scenario simulations, decision trees or exploratory learning
	super-real presence	using ad hoc computer-generated images which help in reducing personal involvement and structuring your perception (‘to see both the wood and the trees’) with the consequence of improving your decision making and your reaction time in an emergency
	retrospective presence	a personalised recording of your intervention which could be compared to the “best practice” approach and, then, be used as a lesson learned

This is understandable with key events such as interviews or presentations. It is less justifiable with routine meetings, whether they are face-to-face or conducted virtually, that for some people the way the meeting runs is partly a matter of face. They over-prepare, rather than risk being revealed as unprepared. Over-preparation for meetings has been noted in 'face-to-face' conferencing systems and groupware and seems likely to continue with today's groupware systems, whether they are true 'face-to-face' systems or systems that provide some form of virtual presence, through avatars, icons, sounds, etc.

Increasingly, one can choose whether a first encounter is physical or is technology-mediated (e.g., a virtual encounter, via an avatar or surrogate). Our contention is that 'anticipatory presence' is relevant to technology-mediated encounters such as are possible using mobile devices.

From the perspective of anticipatory presence, any first encounter can be considered in terms of where it takes place as well as what may take place there. People may want to prepare for the first encounter by virtually exploring the physical space in which the first encounter will take place. Their reconnoitre options include:

- viewing a video of someone moving through the actual space. If such a video is viewed on a screen in a fixed location, it provides little sense of 'being there', so it is said to offer low anticipatory presence;
- controlling a robot camera that moves through the actual space. This provides medium anticipatory presence;
- being depicted as an avatar, and traversing a medium-fidelity virtual reality simulation of the actual space. This provides higher anticipatory presence;
- as above, but with high-fidelity virtual reality and greater scope for user engagement (e.g., haptic feedback via data gloves; visual feedback by being depicted as a human avatar who looks like them). This provides the highest anticipatory presence.

In every case, the sense of 'being there' can be increased if the display device, and what is shown on it, is sensitive to the position of the viewer and the rate at which they are moving. This then allows the viewer to move 'with the camera'. We believe that a feeling of extra realism results if the viewer has to move physically, to see the next part of a recording or to explore a different part of a space. This introduces the prospect of being able to satisfy Bakalakos [1] and "create and share video recordings that are 'rich, coherent, replicable and extensible to other applications and domains'."

Turning now to exploring possible events at a meeting, this may mean exploring different scenarios, through participation in a virtual reality simulation or even a mock-up of each scenario, using actors. As with a spatial reconnoitre, the greater the degree to which participants are able to engage with the activity and believe what they see and feel, the greater the prospect of being able to prepare them for the actual turn of events, via anticipatory presence.

So far, we have implicitly considered anticipatory presence as being limited to an individual. It hardly needs to be said that considerations of presence also apply to groups of people who may be exploring a place or a scenario. Each person in a group will need to be represented to others in the group, and may wish to know whether they are visible to the rest of the group, how they look, and whether they are being looked at. Their presence may be shown in different ways, according to whether they are 'there' at the same time (synchronous presence) or at different times (asynchronous presence). In the latter case, it may be necessary to differentiate further, to indicate whether someone has yet to arrive, or has already been 'there' and has left, or will be returning. Further, a sense of presence ("Jean was here and looked at this") can be sustained after Jean has left, if Jean's visit is marked in a way that late arrivals notice.

While the concept of anticipatory presence has merit, it remains difficult to implement as we have described. The implementation challenges are partly a function of the all-too-obvious limitations of today's technological infrastructures, interfaces and devices, particularly mobile devices.

For example, one issue is how to provide the necessary high degree of aural and visual immersion, to facilitate the feeling of 'being there'. Current hand-held devices have small screens that occupy very little of our visual field. While they could be replaced by goggles or other forms of head-mounted displays, there are significant constraints on the quality of the video images that can be shown on such displays, and on the bandwidth that is available to mobile devices to refresh the video. Furthermore, as yet there are no location-based technologies that are simultaneously inexpensive, cable-free and offer the geographic range, fine resolution, position-sensitivity and rapid response that are required to be able to track someone's movements and then change what they see to take account of those movements. These issues are being addressed by projects such as Ambience [7], which is exploring them in the context of developing an 'Ambient Intelligence' environment that is aware of the presence and context of each user, and is sensitive, adaptive, and responsive to their needs, habits, gestures and emotions.

Even when those technical challenges have been resolved, there remain some basic perceptual challenges. For example, people may need to switch their attention and their associated presence between two or more tasks. In the case of a first visit to somewhere, this might mean paying more attention to where you are (to ensure you do not get lost), than to a secondary task (such as following the flow of a discussion or looking for someone or something).

"... the object, event, goal, or line of thought that we focus on depends on the interaction of two sets of activity... The first is the set of knowledge-directed, endogenous processes that depend on the observer's current knowledge, goals, and expectations about the task at hand. The second set of processes is stimulus-driven, exogenous processes, where attributes of the stimulus world elicit attentional capture or shifts of the observer's focus. These two sets of processes combine in a perceptual cycle... where unique events in the environment shift the focus of attention, call to mind knowledge, and trigger new lines of thought... the design of external representations, support tools, and communication media affects practitioners' abilities to remain peripherally aware of other events and others' activities, either supporting this cognitive function or undermining it." [8]

The literature that quotation is taken from leads us to the conclusion that the kind of presence being offered at any moment should change in accordance with the stage in the 'perceptual cycle' and take particular account of human limitations in peripheral awareness.

Thus, users in an immersive environment should be considered to have little spare capacity to monitor changes outside that environment, including changes in the presence of other people. This provides additional roles for mobile devices, as tools for directing your awareness at critical times, and tools for negotiating with the devices used by people who are 'there' in your shared space, so that they can be made aware of each change in what you pay attention to.

12.4 Super-real presence

There is a considerable literature on 'mixed reality spaces', meaning connections and layers between real and virtual spaces, as well as on conceptions of presence that could be extended in that way [9-11]. For example, the Esprit project eRENA [12] reviewed a

number of ways of creating shareable mixed realities ‘ including Milgram’s augmented reality and augmented virtuality. Respectively, these involved overlaying text, graphics or sounds on a real world scene so that the digital data seems to be attached to physical objects, even if they move); and overlaying representations of physical objects within a virtual world. The example used in eRENA was textured video views, for example views of participants’ faces on their avatars.

Similar approaches will be explored in MOBIlearn, with the difference that the intention is to move from a laboratory environment, towards larger-scale implementation, in which it will become increasingly feasible to provide some degree of ‘ambient intelligence’ to monitor and support users (e.g., the Ambience project, [7, 13]).

For comparative purposes, the studies in MOBIlearn are likely to include some replication of previous work on delivering limited forms of augmented reality (e.g., [14-16]). An example is the use of PDAs to enhance user experiences in the Exploratorium museum in San Francisco. Presence was not supported in those trials. They were concerned with supporting directed interpretation of exhibits. In one approach, the screen displays presented annotated still images of key phenomena. Users would see something similar if they moved to specific marked places. Other work that we shall build upon includes the CIMI Consortium’s Handscape Project [17], part of which is exploring the possibility of using mobile devices in museums to provide personalized information trails, spaces and mixed realities of the real and virtual.

The Handscape project raised the possibility of ‘creating context dynamically, in collaborative spaces’. Those collaborative spaces would allow virtual exploration of the museum and its linked resources (e.g., its library) by visitors at a distance. Given some form of super-real presence, they could interact with exhibits and with each other, and conceivably could also interact with physical visitors. As yet, this is far from realisation even on a small scale, let alone the ‘industrial scale’ required in major cultural venues.

How one might provide such a service is one of the areas to be explored in depth in MOBIlearn.

12.5 Retrospective presence

It is increasingly difficult to tell when changes have been made to photographs or audio or video recordings. What is still at the limits of achievability is being able to modify video images to remove a person or to make them appear to do different things. While it is possible to do this slowly, frame-by-frame, current computers struggle to alter video streams in near-real-time. But even personal computers now have sufficient power to run software that will meld images and sounds, bringing the technical possibility of being able to make people appear to say anything. Technically it is feasible to alter reality in ways that are on the margins of social acceptability, and to create false memories. This raises many ethical questions. So much for the dark side of retrospective presence.

The positive side of retrospective presence is represented by researchers interested in supporting social tasks, which includes a number of the people involved in MOBIlearn.

Appropriate paradigms here include the use of vicarious learning (learning from the experiences of others). This has traditionally meant such approaches as recording students as they work, editing those recordings to pick out the behaviours that you want other students to emulate, and showing those edited selections to your students. Presence is becoming relevant here, since in principle it could be possible to further edit those recordings so that one of the participants can be made more prominent if they are doing something that you want to draw attention to.

We would not be surprised to see such tools on the market in 2-3 years, although it may be some time before tools are available that allow novice end-users to edit videos so that they appear to be participants.

As an indication of what is of interest to commercial developers, we take note of Microsoft's Social Computing Group [18]. In projects such as PhotoStory and FastForward, they are exploring the possibilities of tools to enable novice end-users to tell stories in a more fluid fashion using photos or videos. In the hands of well-intentioned users such tools will be very helpful in sharing experiences.

12.6 References

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