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From Buddyspace to CitiTag: Large-scale Symbolic Presence for Community Building and Spontaneous Play

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ABSTRACT

In this paper we discuss the conceptual framework and principles that guide our work in the design of large-scale informal environments for collaborative work, learning and play, aiming to foster social bonds and to provide an exciting testbed for emergent social behaviours. We present three different applications we have developed: Buddyspace, an Instant Messaging environment for community building, BumperCars, an online presence-based multiplayer game and CitiTag, an experimental wireless mixed reality game.

Categories and Subject Descriptors

H.5.3 **[Information Interfaces and Presentation**]: Group and Organisation Interfaces---*synchronous interaction, collaborative computing, computer-supported cooperative work, evaluation/methodology,* H.5.1 Multimedia Information Systems---*Artificial, augmented, and virtual realities.*

Keywords

Social computing, emergent behaviour, instant messaging, presence, play, mixed reality games

1. THE CHALLENGE OF ENHANCING SOCIAL PRESENCE

Our research addresses the question of how the technology-mediated presence of large numbers of people can develop into an engaging social experience. We are attracted to large numbers of people not only because we work regularly with a large population of distance learners at the Open University, but also because it is evident that being part of a large crowd in real life possesses a certain 'buzz' of its own, and poses a natural challenge. As Donath (1996) asks: 'Is there a design that would make palpable the sensation that one was indeed on-line in the company of millions of other people?'

We believe that the world of massive online gaming, with virtual communities of thousands using communication technology, can be used as a useful metaphor for re-creating engaging experiences within the context of collaborative work and learning. In the context of distance education in particular, we know from the work of Whitelock et al (2000) that the presence of peer-group members can enhance the emotional well-being of isolated learners and improve problem solving performance and learning. We also know from earlier work with Open University students (e.g. a virtual Pub Quiz for Open University students discussed in Scott & Eisenstadt, 2000) that it is not only possible, but desirable to foster relationships among isolated students by providing recreational social activities.

Rheingold's discussion of *Smart Mobs* (Rheingold, 2002) highlights the overwhelming power of social cohesiveness that can be brought about by knowledge of the presence and location of others in both real and virtual spaces. Acts of spontaneous collective play, like the recent Flash Mobs phenomenon, have been thought-provoking within the context of our research. We have been investigating how presence-aware and ubiquitous technologies, can foster group identity and enable the expression of spontaneous social behaviours through play.

2. DESIGN PRINCIPLES

We present the key building blocks for our approach to large-scale presence based applications below:

2.1 Big scale is an asset, not a liability

We look at large scale as a key enabler and an important starting point of our work. Certain interactions, typified by crowd phenomena such as swarming, Mexican Waves (Farkas et al, 2002) and Flash Mobs can only happen at large scale. A striking example from the online gaming world, is the case of Cloudmakers, a group of more than 7,000 online puzzle solvers who attempted to solve real world challenges, thereby further blurring the distinction between virtual and real communities (McGonigal, 2003). We have designed the applications discussed in this paper with large-scale user participation in mind.

2.2 Visualising users' locations can enhance the sense of presence online

We know that the presence of large numbers of people can be represented visually using density plots on maps (Dodge, 2000), and in very compelling ways such as the NASA Earthlight maps (NASA, 2000) which show the most densely populated areas on our planet via a stitched-together global panorama of night-time satellite photos showing city lights . Such visualizations provide an important and familiar grounding for large-scale presence. In the context of collaborative work and learning, being able to identify and locate fellow students/workers in *one's region* or *close by* in order to form a self-support group is invaluable.

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2.3 'Presence' is largely symbolic:

2.3.1 Presence can be rendered symbolically in an online context

We believe that 'presence' is about the sense of 'being aware' of other people's existence and that this feeling is both *necessary* to achieve communal impact and *sufficient* to induce the appropriate sense of 'feel good' or 'buzz' in others. In the online world, presence can be conveyed symbolically via the display of meaningful *state* information (e.g. availability, activity, location, team identity etc). As an indication of the benefits of merely symbolic presence, Nardi and Whittaker (2000) report that people in their study of Instant Messaging use in the workplace found value in simply knowing who else was 'around' as they checked their buddy list, without necessarily wanting to interact with buddies.

2.3.2 Presence can be overlaid symbolically in a mixed reality context

In ubiquitous computing environments, presence becomes a richer concept creating a hybrid space of mixed reality, as virtual (symbolic) presence can be combined with physical (real) presence, through *state* information display similar to 2.3.1, but more suitable for the real world (e.g. location, proximity, direction). We believe that symbolic presence states can be superimposed over physical presence, in a way that both *enhances* the feeling of being part of a parallel virtual experience and also *facilitates* the emergence of spontaneous social behaviour in the real world.

2.4 Design for emergence

We know that in the real world 'crowds behave': spontaneous collective behaviours can emerge even without leaders or rules. A significant part of our work has been focused on how we can design for the emergence of 'crowd' behaviour online. Furthermore, internetworked groups of humans can exhibit emergent prediction capabilities (Rheingold, 2002) and thus demonstrate self-organizing dynamics. The possibility of the emergent social behaviour, enabled by mobile technologies, constitutes an important research area and we have taken a step towards this direction as described in section 5.

We discuss three different applications that integrate these principles below: an Instant Messaging system, an online multiplayer game and a wireless location-based game.

3. BUDDYSPACE: COLLABORATION WITH ENHANCED SYMBOLIC PRESENCE

3.1 The environment

To understand what it would mean to foster large-scale on-line presence, we looked at ways to leverage the widespread interest in (and takeup of) Instant Messaging. We felt that in certain contexts, including that of thousands of distance-learning students at The Open University, large scale presence would clearly contribute to a 'feel good' factor, but would require a special kind of visualization that needed to be superior to a conventional 'buddy list'. We analysed just over 1000 discussion forum messages of students enrolled in an Open University foreign language course, and found that nearly 20% of the messages in the first month of the course where highly location-centric, along the lines of "is there anyone here from Manchester?" This suggested to us that location-centric displays would be both motivating to the users and also suitable for large-scale visualization, as proposed in our design principle in 2.2. Combining messaging, symbolic presence, large scale visualizations, and geolocation led us to generalize the 'buddy list' to a 'buddy space' and *BuddySpace* instant messenger was born (Figures 1A, 1B).

BuddySpace not only includes automatically-generated group membership (e.g. the clusters in Figure 1A beginning with "[OU]"), but also provides maps representing each group member's location, allowing a 'newcomer' to find people studying the same course from the same city or a nearby location. This is done by a server-side component accessing corporate directories and other information systems. Personally-created groups are also catered for. In Figure 1B, we see one user's view of work colleagues filtered through four custom maps: office layout, world, UK, and European views. 'Cluster dots' are larger groups of personal contacts into which the user can 'drill down' with a right-mouse click. The map displays can be scaled dramatically, while still remaining meaningful to the end-user, by deploying a variation of the algorithm producing the clusters (Komzak & Slavik, 2003) – used with great effect on existing 'HitMaps' displaying up to 80,000 people distributed around the globe (Komzak & Eisenstadt, 2004).

In addition to the typical IM 'states', presence is rendered symbolically with specialist ones such as 'low attention' and 'online but elsewhere' for mobile workers who are not where their colleagues think they are.

3.2 BuddySpace results and discussion

At the time of writing, BuddySpace has been downloaded by about 18,000 users. Users range from hobbyists to universities and corporate clients looking for enterprise-wide deployment of a custom messaging platform. The biggest long-term use comes from our colleagues within the Open University, and from Open University students taking specific courses that have opted to deploy BuddySpace as a community building tool. From 15 questionnaires collected from long-term (> 6 months) BuddySpace users, these are the key findings:

3.2.1 Automatically-generated groups and enhanced 'state' information are perceived as the most beneficial and most frequently-used feature of BuddySpace

Users rated 19 different features of BuddySpace on a 5-point scale of perceived 'Benefit' ('very un-beneficial/very detrimental' to 'very beneficial') and 'Frequency of use' ('very rare (never or almost never used it)' to 'very frequent (used on most sessions)'), as shown in Table 1.

The ability to use changeable and enhanced presence states (i.e. not only the typical 'do not disturb' and 'away', but also our custom ones such as 'low attention' and 'online but elsewhere'), along with automatically-generated group lists, emerged as the overall mostly valued features, in terms of their combined scores on both benefit and frequency.

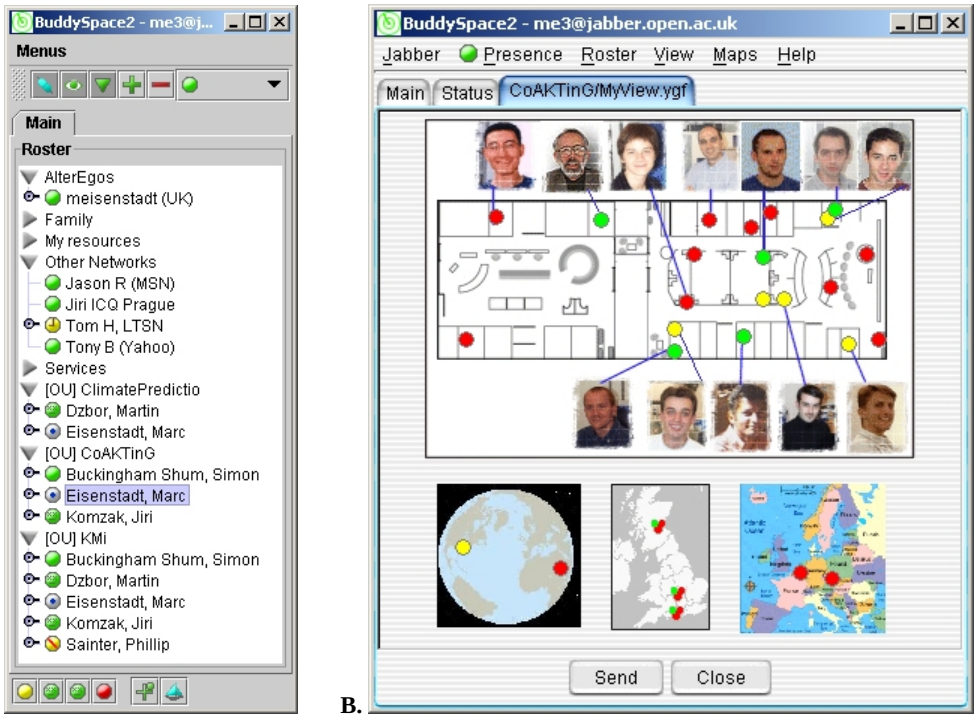

Figure 1. BuddySpace in a work context. The conventional buddy list (A) is augmented by map displays (B).

Table 1: The top four features of Buddyspace, along with a representative middle and low-ranking feature

Feature	Benefit	Freq.	Combo
Ability to change 'Presence' (online/away/etc)	4.07	3.13	**3.60**
Automatically-generated groups	3.60	3.20	**3.40**
The 'Low attention/busy' presence state	3.80	2.87	**3.34**
The 'Online but elsewhere' presence state	3.67	2.40	**3.04**
… [6 features omitted from this table for brevity] …	…	…	…
ICQ/MSN/Yahoo/AIM transports/gateways	3.33	1.52	2.43
… [7 features omitted from this table for brevity] …	…	…	…
Bookmarks	2.67	1.33	2.00

3.2.2 Presence can indeed be conveyed symbolically

this endorsement of one of our key principles is an additional consequence of the analysis just presented: in Table 1, three of the top four features in terms of benefit and frequency of use are concerned with purely symbolic state changes.

3.2.3 BuddySpace maps, personal rosters and group rosters engender a strong sense of community belonging

We asked our long-term users to rate the extent of 'group belongingness' engendered by a sample of 20 activities, events, and physical artifacts in the workplace, using a 7-point Likert scale (from -3 = 'very negatively: not only do I not feel a part of this group, I feel very negatively about it' to +3 = 'very positively: I associate very positively with this group'). These 20 items ranged from corporate logos and political rallies (intended to provide a baseline for strong belongingness) to BuddySpace-specific items such as dots on maps, presented to the users in a randomized order. Average scores ranged from the +2.07 for 'membership of self-created buddy list' to -2.33 for 'stuck at a rally with supporters of my political rivals' (average rating -2.33). Importantly for us, the items 'appear as dot on an office map', 'appear as a dot with thumbnail photo on an office map', 'membership of automatically-generated list' and 'membership of self-created buddy list' all ranked within the top 5 items, rivaled

only in 'belongingness-power' by the feeling instilled by seeing one's corporate logo in a newspaper ad! This is a strong endorsement of the notion of 'feel-good factor' in group identity which was one of the motivating factors of this work.

In summary, our user study of Buddyspace indicated how group visualizations with enhanced symbolic presence, incorporating location information, can facilitate entry (automatically generated groups) and further encourage a feeling of participation (group belongingness) in a community.

4. COLLABORATIVE PLAY=> FACILITATING EMERGENT BEHAVIOURS ONLINE

Our aim in this project was to find out in what ways people's presence can be used to facilitate collective recreational activities and emergent playful behaviours, based on the awareness of 'what other people are doing at the moment'. The basic challenge is to provide 'just enough' of an environment that is conducive to forming rules and relationships rather than enforcing them. We have developed a scalable 'playground space' as an experimental testbed for our principle of design for emergence, discussed in section 2.4. The rationale is that by encouraging people to use their symbolic presence in playful and creative ways, spontaneous group behaviours can emerge, much like 'flocks' or swarms.

4.1 The environment and our games

Our 'playground space', is essentially a 2-D multiplayer Bumper Car game, designed to be launched via a plug-in to BSM. At its most basic, this game is about driving around, 'bumping' and chasing. However, put many people in one arena, and interesting patterns emerge. People can dynamically declare their 'allegiance', which is reflected in the colour of their bumper car (e.g. there are pair/triples of orange/green cars chasing loners in Fig. 2).

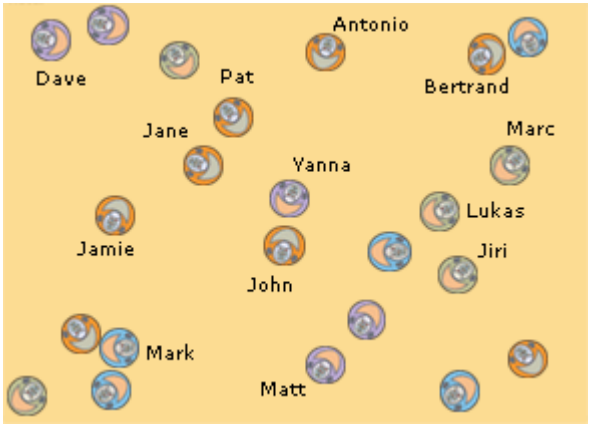

Figure 2. The BumperCar game: alliances are formed among cars with the same colour.

We carried out six experimental online sessions of approximately 20 minutes each with twenty-two participants in total who were recruited across the Open University campus. We altered the challenge for our participants, providing three types of games (two experiments of each type) within the bumper car game. The game application was exactly the same in all three types of experiments below – we only changed the background image and the instructions about the rules of play:

- *A colour change jam session*. Participants were invited to form two teams and to try to make rhythmic synchronized colour changes with their team members as if they were participating in a competition – though with abstract and purposefully loosely defined 'artistic' criteria.

- *Group formations and chasing*. In this case participants were asked to form groups on the fly, based on their colour identity to chase other cars together.

- *A collaborative Pong game*. Participants were divided into two teams in advance to play a Pong game by defending either side of the screen and trying to send the ball (a randomly moving 'car bot') towards the opposite team (Figure 3).

In this way the context ranged from a less goal-oriented and unplanned activity (jam session) to goal-oriented play (collaborative pong).

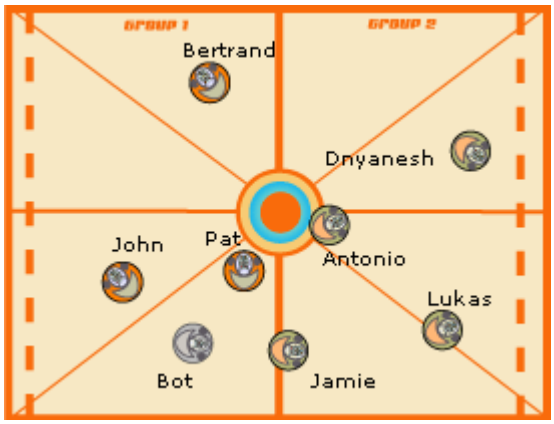

Figure 3. Collaborative Pong among two teams

4.2 BumperCars results and discussion

We recorded all onscreen interactions from our six online experiments on video and collected participant feedback by email questionnaires as well as face to face follow-up discussions. Several interesting observations have emerged from this study:

4.2.1 Teamwork is possible even with no verbal communication.

We observed both spontaneous forms of teamwork as well as goal-oriented cooperation:

a) Spontaneous teamwork. In group formations and chasing we observed swarm- like movement, alliances on the fly and spontaneous unpredictable clustering on one spot at the end of one experiment. There were two participants who came up with a spontaneous 'victory' dance pattern (as one of them described it) – they rotated lively around themselves every time they succeeded bumping someone else together. There was no verbal communication, so all these unplanned collaborative behaviours emerged impromptu. This brings forward our aforementioned point about presence being largely symbolic, we can see how in a given context, a certain movement acquired a new meaning

(dancing to celebrate), became a unique symbolic act without the need to communicate it explicitly.

b) Goal-based teamwork. We organized a collaborative Pong game session (Figure 3), which participants turned to Soccer! All seven participants found the game engaging, they enjoyed: 'the *'school boy football' style'*, *'being in a team'* and *'the strategic aspect of the game'*. One participant reported that he liked the fact that his team seemed to *split automatically into 'defenders' and 'attackers' without having to talk about it*, yet another example of emergent, unplanned collaboration – based on the awareness of other people's activity.

4.2.2 Self-organisation and bottom up behaviours emerged.

In the colour jam session experiments, synchronized colour-changes and creative 'dance-like' movements were observed regularly among two groups of five. It was very interesting to watch, how, once some synchronization emerged (e.g. copying each other's colour), people started to introduce complexity in their moves and their teams followed! While a very simple case, this indicates that real-time self-organisation can indeed emerge in minimal, presence based online multi-user environments.

4.2.3 Interesting forms of 'crowd' behaviour online were observed: rogues & creativity.

In several experiments, a creative individual emerged, much like a playground 'wise guy' who tended to ignore the game context, for example, by 'bumping' other players out of their parking places. Frequently, others imitated those behaviours. Emergent play occurred: participants ended up spontaneously swapping places, sometimes even 'offering' their place to others! The same 'rogue' individuals were also good innovators, taking up initiative in various contexts, for example to introduce interesting complex patterns for others to follow. In the real world, various aspects of creativity and leadership follow very similar patterns: a 'self-assumed' leader or 'innovator' starts some activity, and later fellow workers follow.

Our online 'playground' experiments illustrated how spontaneous collective social behaviours and *ad hoc* group coordination can *emerge* online, even without verbal communication.

5. EMERGENCE IN THE REAL WORLD: CITITAG

This phase of our work employs our principles of symbolic presence and design for emergence, in the real world, in a mixed reality game. CitiTag is an exploration of social experiences, emergent behaviours and group play in public spaces through the use of mobile technology. The project is motivated by the hypothesis that a very simple game based on symbolic presence states can result in an enjoyable shared social experience, stimulated by real world interaction among players. We have found playground games (Opie and Opie, 1969) particularly inspiring because of the simplicity and sense of instant 'fun' in some of them that occur spontaneously. CitiTag originates from the concept of children's 'tag' or 'tig', aiming to recreate this sense in a ubiquitous computing context.

5.1 The game

CitiTag is a multiplayer, wireless location-based game, played using GPS (Global Positioning System) and handheld, iPaq Pocket PCs connected to a wireless network. The game has been designed to be scalable, potentially as an everyday experience one could have in the future with a mobile phone while walking about in a city centre.

Figure 4. Tag alert. Numbers of red (top left) and green (top right) players, free and tagged.

As a player of CitiTag, you belong to either of two teams (Reds or Greens) and you roam the city, trying to find players from the opposite team to 'tag' by getting close to them. You can also get 'tagged' if an opponent gets close to you. If this happens, you need to try and find a team member in the vicinity to set you free, to 'untag' you. Each game event (e.g., someone is close and you can tag/untag them) appears as an alert on the iPaq screen with a sound and you need to tap the screen to 'tag' (Figure 4) or 'untag' (Figure 5). At every moment you can see the group state, i.e. how many players of each team are free and how many have been tagged (see top of the screens in Figures 4, 5).

The game has a lightweight design to serve as an awareness feature and a trigger for what happens in the real world. Here, proximity rather than actual location is what strengthens the sense of virtual, symbolic presence (e.g. along the lines of 'I am Green and tagged'), superimposed on physical.

5.2 CitiTag results and discussion

We carried out two user trials: a pilot trial with 9 participants in an open field space at the Open University campus and a trial with 16 participants in a square in the city centre of Bristol (Figure 6). Both trials were filmed and were followed by group interviews, in addition to which all participants completed a questionnaire about their experience with CitiTag. Here is a summary of our results:

5.2.1 Collective behaviours and self-organisation can spontaneously emerge

Observation during the trials and video analysis revealed a range of emergent group behaviours; among the most typical ones were running and surrounding other players, much like our online group formations experiments, but in the real world with real players! When players found people from their own team, they would often move along together, forming increasingly larger clusters, as this made them stronger against lone opponents.

We also observed an 'invincible pair' in Bristol: two players who spontaneously teamed up and kept rescuing each other. What is special about this case is that they did not agree on the strategy explicitly, they '*didn't need to say: let's do this*'.

So we see how strategies emerged impromptu, through the exploration of simply designed technology. Self-organisation among the two teams became evident from game logs: initially one team won quickly over the other, but later, as strategies evolved, the teams learned to fight back, so the game lasted longer and the numbers of tagged people kept going up and down with often surprising last minute victories.

Figure 5. Alert to rescue a tagged team member in vicinity

5.2.2 Creative individual and rogue behaviours were observed

In both user trials we observed a range of inventive actions, often initiated by one individual and then copied by others. One of the most typical ones was to use gestures to attract attention from a distance, like waving or raising hand to indicate having been tagged, performed by at least five different people in Bristol. The same behaviour was also observed at the OU trial by a participant who said that he remembered this from playing 'tag' games in childhood. Other tactics were following others secretly and hiding to wait for passers by. A 'rogue', or playground 'wise guy' in Bristol created the role of the 'assassin' in the game: he cheated by joining the opposite team and then switched back to the original team at the very last minute to 'tag' as many people as possible whilst being among them. This is an interesting example of a person exploring the possibilities of mixed reality: being physically with one team, but virtually with the other.

Figure 6. User trial in the centre of Bristol

5.2.3 Symbolic presence can enhance the feeling of participation in a parallel shared virtual experience

In the Bristol trial we found a significant correlation between feeling part of the team (Reds or Greens) and the usefulness of the figures on the top of the device's screen, used in the game to convey the group state, i.e. how many players of each group were tagged and how many were still free (Pearson Correlation .794, df= 15, p= .000). This suggests that symbolic group presence, along the lines of 'there are 3 free Greens out there' can enhance the sense of participation in a superimposed virtual group.

This result is further supported by the fact that our participants in both trials valued the group presence state feature of the game: 19 out of 25 participants in total rated its importance between 70-100 on a 100mm scale of 0 (not at all important) to 100 (very important). Moreover, at least 8 participants added in the questionnaire and many confirmed during the interviews that they wanted to be able to see more people in proximity on their screens, including members of their own team.

To summarise, our experiments with CitiTag brought into light emergent phenomena in the real world, through a mixed reality game based on simple rules and the overlay of symbolic presence over physical presence.

6. CONCLUSIONS AND FURTHER WORK

Our approach to the design of large scale environments for fostering community bonds and encouraging spontaneous social behaviours has been examined through the deployment of the three applications discussed in this paper. The results highlight how scalable, lightweight technologies for collaborative, social and recreational use, based on symbolic presence, can both enhance the feeling of group belongingness as well as provide a testbed for emergent group behaviours, in both virtual and ubiquitous computing contexts. In particular, our preliminary findings on the use of BuddySpace endorse our long-term goal of

fostering a sense of 'group belongingness' through the use of presence-based tools in the workplace and in distance education. Our 'playground' experiments with BumperCars illustrate how collective social behaviours and group coordination can emerge online impromptu, even without verbal communication. The further implications of such emergent social interaction we believe are among the essential challenges for future generations of collaborative work and learning support tools. Finally, our CitiTag experiments show that similar group interactions and spontaneous behaviours can emerge in the real world, empowered by participation in a mixed reality shared experience, based on simple game rules and symbolic presence states. Our findings open up opportunities for further research in the design of large-scale multiplayer games and presence-based social applications in ubiquitous contexts.

In future work, we aim to refine our concepts through iterative design and user feedback and to proceed with increasingly larger scale studies on these fronts, to discover yet unknown interactions.

7. ACKNOWLEDGMENTS

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