Designing multiplayer games to facilitate emergent social behaviours online

CASE STUDY

Designing Multiplayer Games to Facilitate Emergent Social Behaviours Online

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This paper discusses an exploratory case study of the design of games that facilitate spontaneous social interaction and group behaviours among distributed individuals, based largely on symbolic presence 'state' changes. We present the principles guiding the design of our game environment: presence as a symbolic phenomenon, the importance of good visualization and the potential for spontaneous self-organization among groups of people. Our game environment, comprising of a family of multiplayer 'bumper-car' style games, is described, followed by a discussion of lessons learned from observing users of the environment. Finally, we reconsider and extend our design principles in light of our observations.

Keywords: social computing, presence awareness, spontaneous group play

1. INTRODUCTION

The social interactions afforded by online communication environments such as Instant Messaging have heralded a new era in 'social software' (Allen, 2004). Instant Messaging presence 'state' changes (e.g. online, available etc) provide the simplest form of signaling communication, even without the available chat facility. It is evident that online multiplayer games are vehicles for rich social interaction and engaging shared experiences. Our work is aiming to bridge the best of both worlds: the simplicity and immediacy of Instant Messaging presence with the enjoyment and sense of social participation experienced in multiplayer games. We are interested to find out to what extent the plain, symbolic interactions typified by the presence changes seen in instant messaging environments can be leveraged to facilitate social behaviour online. In particular, can *emergent* behaviours, somewhat unpredictable and not necessarily even embodied in game rules, be facilitated and observed in simple online games?

We are particularly focusing on emergent interaction, because it can vary the user experience depending on group dynamics, therefore prolonging social participation. In this way, it is possible to have a game that is interesting to play more than once. Emergence is a particularly intriguing buzzword for game designers (Garneau, 2002) as they try to incorporate emergent properties in their games to enhance the user experience.

We are motivated by the question, 'can the awareness of many people online be turned into an engaging shared *social experience*?' 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. We also 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.

There is a considerable research effort in design solutions that make use of abstract visual information to convey social meaning and help us interpret and understand patterns of online communication. In 'Chat Circles' for example, a prototype for visualising conversation, presence and activity are made manifest by changes in colour and form of the participating entities (Viegas & Donath, 1999). The Babble System, a group discussion tool, attempts to make perceptually-based social cues visible to its users, by supporting mutual awareness and accountability (Erickson et al, 2002).

A prime area where communities of thousands of active participants are already in place and use communication technology extensively is that of massively multiplayer online games and virtual worlds, such as Everquest and Asheron's Call (Asheron's Call website, 2004). The sense of others being present among these large groups of individuals is essential to stimulate social interaction in virtual worlds. The world of massive online gaming can be used as a very useful metaphor for re-creating a similar experience within non-gaming contexts. For instance, the IBM Social Computing group that created Babble, mentioned above, also created WorldJam (Halverson et al., 2001) the largest-ever corporate online brainstorm, which leveraged the crowd 'buzz' that we are interested in to collect ideas from over 50,000 IBM employees in a 72-hour period. Research in first-person-shooter (FPS) multiplayer games (Nova, 2002) also suggests that the elaborate tools used for team awareness and coordination in these games can be employed with appropriate re-design for workspace awareness and collaborative work.

Our current work explores the ways in which people's presence can be used to facilitate chance encounters, collective recreational activities and spontaneous social interaction, based on the awareness of 'what other people are doing at the moment'. According to Christiansen and Maglaughlin (2003), group awareness enhances the feeling of belonging to a group. Non-verbal communications, spontaneous interactions, informal and physical presence are all elements of face-to-face interaction that can promote a sense of community. Earlier work in online learning environments – in particular a virtual Pub Quiz for Open University students (Scott & Eisenstadt, 2000) – shows that it is not only possible, but also desirable to foster relationships between isolated individuals through recreational social activities. We also know (Desouza, 2003) that workplace game rooms enhance tacit knowledge transfer at work. What are the equivalents of these 'chance encounters' during recreational activities in the virtual, presence-mediated worlds? We have found playground games particularly inspiring for our study, because of the sense of instant 'fun' in some of them that occurs spontaneously. This happens, for example, when one child challenges another, while walking in the street in a group, to play a game of 'tag' and they then start chasing each other. As Opie and Opie (1969) mention in their book on playground games, play is unrestricted, while games have rules; in the playground there is no need for an umpire, little significance is attached to who wins or loses and it doesn't even seem to matter if a game is not finished.

To explore the emergent properties of play online, we conducted a series of preliminary studies with small groups playing games. We are particularly interested in minimalist games that involve only a small rule set and very simple symbolic communication among players, in order to try to get to the core elements of playful social interactions and to allow spontaneous behaviour to emerge without too much intervention.

2. DESIGN PRINCIPLES FOR A 'PLAYGROUND SPACE'

In a similar spirit to 'tag', we have designed and developed an online application, as a 'playground space' to be used spontaneously for different playful social activities. We plan to integrate these activities with our Instant Messaging environment, Buddyspace – a communication and collaboration tool incorporating advanced presence awareness features (Vogiazou et al, in press) for Open University students. BuddySpace generalizes the concept of 'buddy list' to include optional geo-location and personal profile data – this enables a mixture of personal and automatically-generated contacts to be displayed with their real-time presence information in a custom and compelling visualization.

One of the broader scopes of this research is to learn how we can design environments in which participants can not only demonstrate spontaneous social behaviours, but also eventually create their own activities and invite others to participate. We believe that such freedom to change the context of social interaction could encourage the formation of self-constructed groups. Dynamic interaction is central to fostering relationships in communities. People can participate in activities they find more interesting or which better match their skills and at the same time get the opportunity to come in contact with like-minded individuals.

Before describing the application and our experiments, we present the following motivating themes that have guided our work. These are not intended as hypotheses for testing at the present stage of our research work, but rather act as key building blocks for our approach to presence-based environments for social interaction and play.

2.1 'Presence' is largely symbolic.

Much work on 'telepresence' concentrates on fidelity to real-world appearance, video tunnels, tele-operators (robot arms), 'being there' or representations such as avatars to convey a sense of realism (Lombard and Ditton, 1997). This approach is common in action first-person-shooter games, like Counterstrike, which are very realistic and represent the highest level of response to user input (Manninen, 2001). Distilling these approaches to their core, we can also think of presence as primarily the sense of 'being aware' of other people's existence. Biocca et al (2001) describe presence as the sense of *being there in other places* and *being together with other people*, distinguishing between 'telepresence' and the social presence we are interested in, respectively. In the online world, presence can be conveyed symbolically via the display of meaningful *state* information (e.g. availability, activity, location, team identity etc). We believe that this sense of 'being aware' of other people's existence is both *necessary* to achieve communal impact and *sufficient* to induce the appropriate sense of 'feel good' or 'buzz' in others. 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.

2.2 Good visualization is an important key to scalability.

We know that the presence of a large number of people can be represented visually using density plots on maps (Dodge and Kitchin, 2000), and in very compelling ways such as the NASA Earthlight maps (NASA, 2000) which reveal the most densely populated areas on our planet via a stitched-together global panorama of night-time satellite photos showing city lights. Other examples of this, some depicting the rich variation in relationships among people, can be found in social networks visualisation

(Freeman, 2000). The HitMaps visualization of Komzak and Eisenstadt (2004) provides a highly scalable visualization of the locations of tens of thousands of visitors to blog sites in a tiny 'gutter' display. Previous analysis (Vogiazou, 2002) of existing massively multiplayer games (e.g. *Asheron's Call*, *Everquest*) suggests that there is no example in which a player can experience a similar large-scale synchronous participation *in the player's own perceptual space*. This is despite the fact that there may of course be thousands of people playing the same game online at the same time. Players in massively multiplayer games are typically fragmented into separate manageable regions.

We believe that a multiplayer game based on changes in individual presence 'states' can involve many participants and encourage collective and possibly serendipitous activity, *depending largely on the peripheral awareness of others*. In order to support this awareness, people need to be able to see (or hear) the overall 'gestalt' of what is happening; this is why an appropriate visualization of the overall environment is important.

2.3 Online groups can demonstrate emergent self-organisation.

When you put a group of people together, things happen – even without leaders and without rules. We know from studies of self-organization in the disciplines of biology (Holldobler and Wilson, 1994) and mathematics (Wolfram, 2002), that complex collective self-organisation and emergent bottom-up behaviours are not only possible, but quite common. Emergence has been described as a higher-level pattern or macrobehaviour arising out of multiple dynamic interactions between local entities, oblivious to any higher-lever instructions (Johnson, 2001). Furthermore, internetworked groups of humans can exhibit emergent prediction capabilities (Rheingold, 2002) and thus demonstrate self-organising dynamics.

An inspirational example of spontaneous, emergent group behaviour in the real world is the Mexican Wave, which can start with groups as small as twelve people and then spread across thousands (Farkas et al, 2002). We are fascinated by the potential of spontaneous synchronous interaction online and we would like to find out what the equivalent of the Mexican wave phenomenon would be in the online world. Although our case study necessarily investigates this only with small numbers, in the longer term we are interested in applying the lessons we learn here to the design of much larger environments, facilitating emergent play among hundreds or even thousands of people.

3. THE GAME DESIGN

The 'playground space' we have developed to support spontaneous interaction is founded on the aforementioned three design principles:

- *Good visualisation*: being able to see all the other players in the environment and interact within it are very important to promote scalability and we have designed a separate view to address this.
- *Presence is symbolic*: with a simple, symbolic visual design, abstract communication is possible, such as change of colour 'state' to convey group membership.
- *Online groups can self-organise*: our environment is designed to accommodate emergent social behaviours, much like 'flocks' or self-organized groups, encouraging people to use their presence in playful and creative ways.

Our 'playground space' is a two dimensional (2-D) multiplayer Bumper Car game. At its most basic, this game is about driving around, 'bumping' and chasing. These are the key characteristics of the game design:

- Players use keyboards keys to move their car and perform game specific actions.
- Players can change the colour of their car to indicate their team alliance during the game.
- A player can also place a 'challenge' on another player; the 'challenger' then needs to chase the 'challenged' and bump him or her within a certain time limit (Figure 1). Players of the same colour cannot be challenged.
- Initially we provided a parallel chat activity, which we then replaced with visual instructions (Figure 8) to coordinate the game sessions we ran (see section 5.2.1 for details).
- It is possible to vary player speed, change image background and add free-floating moving cars ('bots') to create different games (Figure 3).
- In order to communicate the presence of all people playing simultaneously and to promote scalability, we provided the additional facility of a single overview map, where cars are scaled to small circles (Figure 1).

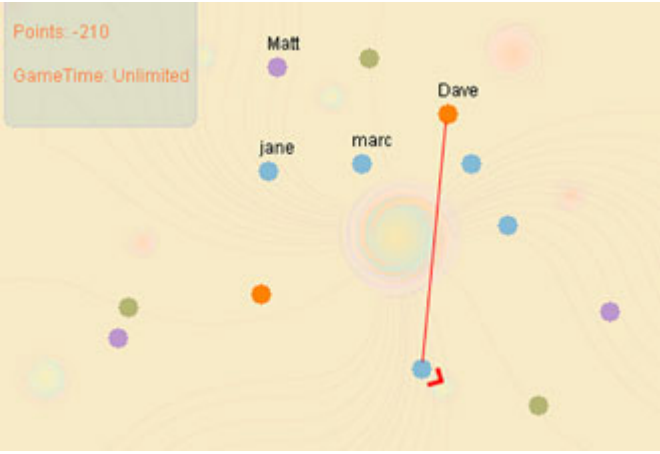

Figure 1 Bumper Car 'map view': the player named Dave has challenged the user, whose screen we are observing.

There is a playability tradeoff between (i) the benefit of being able to interact while observing the whole world gestalt, on the one hand, vs. (ii) the disadvantage of having less

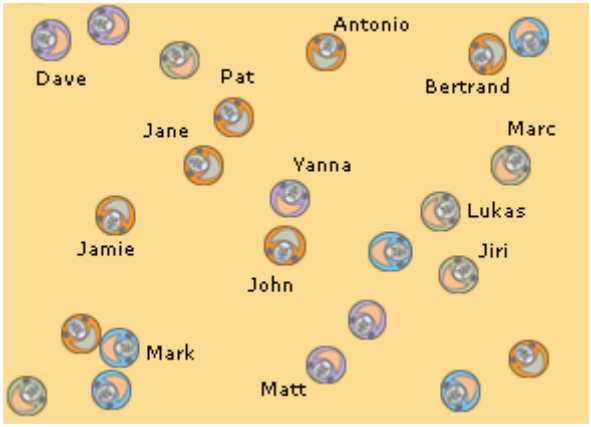

Figure 1 Bumper Car 'close-up' view: a group formations experiment.

of the immediacy and salience of seeing one's own car and region in the close-up view (Vogiazou and Eisenstadt, 2003). For this reason, users switch quickly between views with a single key press.

The basic challenge is to provide 'just enough' of an environment that is conducive to forming rules and relationships rather than enforcing them. Playful interaction is possible in principle even without specific 'arenas' and 'regulations', as we witness daily on school playgrounds. Our design caters for spontaneity and aims to encourage creative behaviour, in accordance with the loose structure and ad hoc interaction of playground games we mentioned above in our introduction.

4. CASE STUDY EVALUATIONS

We carried out online experiments with 22 participants in total from various departments within the Open University campus, each one participating from his/her own office using a desktop computer. We changed only the background image of the game and the instructions about the rules of play, to create three different playful online activities within the same bumper car environment:

a) *A colour change jam session.* Participants were invited to form two teams and to try to make rhythmic synchronised

colour changes with their team members as if they were participating in a 'group jazz dance' competition – though with abstract and deliberately loosely defined 'artistic' criteria. We classified this activity as 'free expression' as opposed to other, more goal oriented activities such as the collaborative Pong game below.

b) *Group formations and chasing* (Figure 2*)*. In this experiment our participants were asked to form groups on the fly, based on their colour identity and then try to chase individuals of a different colour identity. Players could change their own colour/group identity anytime, depending on who they wanted to team up with.

c) A *collaborative Pong game* (Figure). Participants were divided into two teams with different colours to play a Pong game by defending either side of the screen and trying to send the ball (in fact, a free-floating bumper car 'bot') towards the opposite team. This activity was more goal oriented, closer to the concept of structured games.

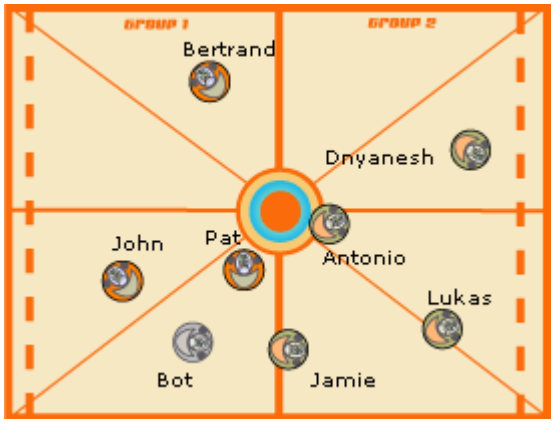

Figure 3. A Pong game among two groups.

Our studies thus spanned contexts of interaction ranging from a less goal-oriented and unplanned activity (jam session) to goal-oriented play (collaborative pong).

Each game was run over two separate sessions, yielding six experimental sessions. We recorded all onscreen interactions from these six online experiments on video and collected participant feedback by email questionnaires as well as through face to face follow-up discussions. Each experiment had 5-10 participants, plus one facilitator, a special bumper car used to signal the start of the game and any change of stages of the game. Many subjects participated in more than one game, since there were 3 different games to play. We collected six approximately 20 minute videos and 36 questionnaires in total.

5. OBSERVATIONS AND LESSONS LEARNED

Several interesting observations on both **group behaviour** and **visual design and communication** emerged from this study, as discussed in depth below:

5.1 Group behavioural observations

5.1.1 Self-organisation and spontaneous group behaviours emerged

In the *colour jam session* experiments, synchronised colour-changes and creative 'dance-like' movements were observed regularly among two groups (Figure 4). Remote participants managed to engage in shared tactics with their team even without verbal communication. Visual clues based on presence, color, and simple local rules that emerged on the fly (e.g. copy the colour of your neighbour) led to a more complex behavior (everyone having the same colour or performing the same pattern) triggered by one individual, elaborated by another and ultimately adopted by all team members. While analysing the videos, we noticed an interesting progression: starting from a phase where people were trying to find out what to do by copying each other's colour changes, they finally came up with quick, coordinated colour changes and wave-like patterns with increased complexity in movement.

While this is a very simple case, it indicates that *real-time self-organisation can indeed emerge in online multi-user environments*. Other group behaviours observed also reminded us of real life collective behaviour.

For example, in *group formations and chasing* (Figure 2) we observed swarm-like movement and alliances on the fly. People demonstrated different tactics, like following the larger team (occasionally this resulted in everyone being divided among two dominant teams/colours) or being a 'rebel' and challenging others to chase them.

At the end of one of these *group formations* experiments something completely unexpected happened: a spontaneous clustering on one spot. Nobody ordered this to happen and there was no way to communicate this idea during the game. When the experiment finished one person approached and tried to 'squeeze' the game facilitator and then the rest just followed! Everybody ended being on top of one other, as in a big 'group hug' (Figure 5).

In another session there were two participants who came up with a spontaneous 'victory celebration' dance pattern (as one of them described it in a follow-up discussion) – they rotated in a lively manner around themselves every time they succeeded bumping someone else together. They managed to synchronise nicely without this being part of the game instructions or having any purpose at all! Again, there was no verbal communication, so these unplanned collaborative behaviours emerged in an impromptu fashion. This underscores our aforementioned point about presence being a 'state of mind'. We can see that, when two people paid close attention to each other in a given context, a certain movement acquired a new meaning (dancing to celebrate), becoming a unique symbolic act without the need to communicate it explicitly or even to attach a definition to it.

5.1.2 Goal-based teamwork

In one *collaborative Pong* game session, participants spontaneously turned it into football, which has quite a different style of play. 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 in the questionnaire that he liked the fact that his team seemed to split automatically into 'defenders' and 'attackers' without having to talk about it. This is an example of emergent, unplanned collaboration – based on the *awareness of other people's activity*. Other, frequently observed, forms of ad hoc collaboration in this game were space divisions: team members often tried to keep a distance from one another dividing their part of the screen into front/back or upper/lower to make sure they covered as much territory as possible. See for example Figure 6, where the Green team (the two cars on the left) has an upper/lower space division while their third member is on the attack. Again, the only way people could come up with this was by observing what others were doing: there were no such explicit instructions, strategies or

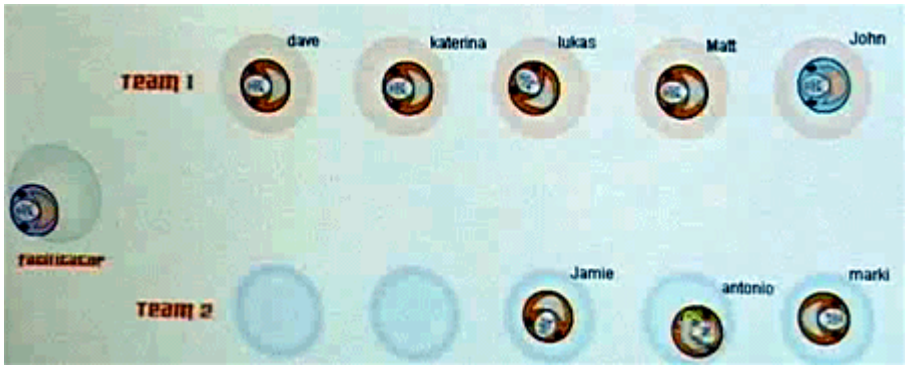

Figure 4 Same rotation angle and gradual colour changing

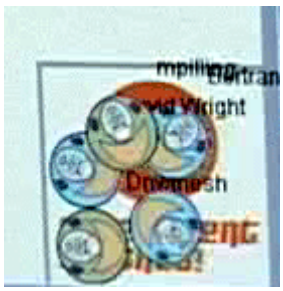

Figure 5 Spontaneous Group Hug!

communication within the game.

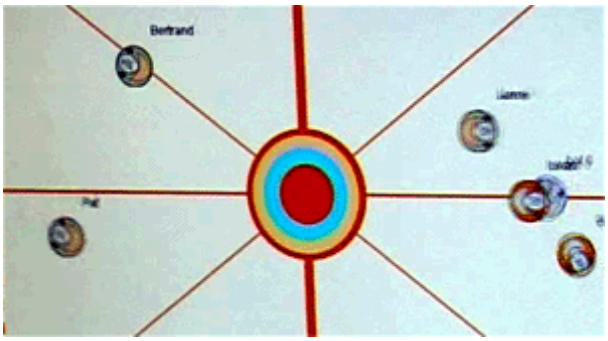

Figure 6 Role and space (upper/lower) divisions among team members

5.1.3 Interesting forms of creative behaviour were observed online

In several experiments, a 'most creative' individual emerged, much like a playground 'wise guy' who tended to ignore the game's context, for example, by driving around other people and trying to 'bump' them out of their parking places even in the non-bumping variants of the game. At one point he even 'stole' the onscreen facilitator's place in the game and seemed reluctant to leave! (Figure 7)

Figure 7 A participant 'stealing' the facilitator's space.

Frequently, others followed this behaviour, too. Emergent play occurred: participants ended up spontaneously swapping places, sometimes even 'offering' their place to others! Several people mentioned the following as fun to do: whenever someone headed for a place nearby, they would come out in front of them to 'steal' it! Here is how one participant described this behaviour emerging in the questionnaire:

> *'Small games happening spontaneously, with no communication! – people start chasing each other. People try and get to a spot first, just because someone else is heading for it. (I did this twice)…*
>
> *Possibly, people mess about because it's fun to disrupt a group's activity – especially. when there is no leader / hierarchy enforcing control , and there is no penalty for messing around, either enforced by the game or dealt out by players.'*

Creative behaviours occur, even within a simple 2-D bumper car game. It is important to point out that the same 'rogue' individuals were also good innovators, taking up initiative in various contexts. For example, the same individual who 'stole' other players' places, tried later to introduce interesting complex patterns for others to follow. He started moving around his parking space in circles and demonstrated this pattern in slower motion as well. Several people followed his pattern which he kept introducing frequently during the session.

In the real world, various aspects of creativity and leadership follow very similar 'rules of formation'. Frequently, there is one 'self-assumed' leader or 'innovator', who starts some activity, and later fellow team members follow.

5.1.4 Strong social aspect: people enjoyed creating their own fun

What participants found most engaging in these game experiments was their playful interaction with others. In fact, the environment often resembled a school playground! For example, they enjoyed 'rogue' and playful group behaviours (e.g. the spontaneous 'group hug' – when they all clustered on one spot). In the *group*

formations experiments, a couple of people mentioned they liked chasing individuals they knew or they 'put on the spot' and another two said they really enjoyed being chased by others, especially by a group of people. In the most goal-oriented type of game, the *collaborative pong*, engagement was associated with pursuing a goal with others and collaborating as a team.

5.1.5 By increasing participant numbers we get variable results and a different user experience

Our experiments showed that even a small increase in the number of participants in these small groups made a big difference in the emerging interaction. For instance, with more participants in *group formations and chasing*, video analysis revealed that larger teams (three or more), chasing a car of a different colour, were more successful than pairs. These teams managed frequently to trap or 'squeeze' a target, as there were more people to cover gaps and to catch up with a chase. We had two experiments of *group formations*, one with five participants and one with eight. There was only one person who participated in both and could therefore compare the experience. After the first experiment with five players, he said he preferred being in a small team of two. He changed his mind after the second experiment with eight players and concluded that larger teams work better. He also mentioned about the second experiment: '*I liked it more than the previous, I was almost all the time in a team of four and sometimes we managed to chase cars together*!'

Also, in *collaborative Pong*, an experiment with seven participants turned out to resemble a game of soccer instead, as people moved altogether around the ball like children do in a playground, while another experiment with four participants proved to be more like the actual game of Pong, since participants remained most of the time on 'their side' waiting for an opportunity to bump (hit) the ball. The first had a 'schoolboy football style' as one participant described it, while in the second, people were much more 'reserved' or defensive, keeping to their side. Even when a participant started performing a more active, 'offensive' strategy by entering the opposite team's territory and attempting 'attacks', he would still go back to his team's side as soon as the attacks either failed or succeeded, as there was a lot of space to cover. Also, given that the 'ball' (a randomly moving bot) moved a little faster than the players – it was more efficient, for a small number of people, to wait for an opportunity, rather than chase the ball around altogether. In contrast, in the first experiment it was possible to move around in a swarm-like manner since there were more people to cover different directions.

Given our commitment to designing scalable multi-user environments, our conclusion here is that there is a critical mass for certain interactions and behaviours to emerge and that the number of people present affects the user experience. For instance, people in the soccer-like *collaborative Pong* session enjoyed it more than people in the rather 'pure' Pong session did. This was a study involving small groups of people; in future work, there might be more emergent social phenomena yet to be discovered on a larger scale.

5.1.6 Summary of group behavioural observations

We summarise the range of behaviours we observed in our experiments in the table below.

Table 1. Group Behaviours

BEHAVIOUR	EXAMPLES
Subvert the game, be a rogue	- Move around bumping others, mess about - Place swapping, offer or 'steal' a place - Steal facilitators place
Try to be a leader-innovator within the game context	- Initiate wave like colour changes or insist on one colour - Move around your space in a pattern
Improvisational, expressive group performance (spontaneous, emergent teamwork)	- Spontaneous Group Hug - 'Victory dance' pattern - Football style 'Pong'
Goal-based teamwork	- Surround a target with others - Divide space to upper/lower or front/back - Take up roles spontaneously: defenders and attackers - Form a block with team members to bounce off the ball
Self-organization	- Keep up a wave of colour change and movement until the neighbours copy it - Copy the colour changes and movements of neighbours - Join other cars of the same colour on the fly in a chase
Trying to draw others' attention	- Be chased or try to be chased - Change colour to make others follow you - The 'rogue' behaviours above

5.2 Observations on the visual communication and design

5.2.1 Visual cues proved very useful for providing context on the activity

In our very first experiment, we ran a separate chat facility alongside the game, in order to coordinate the start and end of the experiment, and also to allow people to discuss strategies and make suggestions about their performance in the game during a specified chat break. We found that it was particularly difficult for people to keep up with the game's activity and at the same time pay attention to instructions in the chat room. The chat was too distracting, particularly when people were trying to come up with something altogether, in our case a rhythmic colour combination. Quite often people were not paying attention at important moments, causing disappointment to the rest who were synchronizing. Also, in this first experiment, five people reported in the questionnaire that they felt 'lost' in the beginning of the session because they or others were not sure about what they were meant to be doing.

We did not use the chat facility in experiments that followed and we improved coordination by providing visual cues about each 'stage' of the session (Figure 8). We observed that these were successful as participants responded and followed the context of the game-event without problems and were much more active and involved. This has implications for the organisation of such online experiments with distributed participants in the form of events: we suggest that clear visual contextual cues are more appropriate than chat to signpost each phase or

specific activity during an online *event* (e.g. wait for others, start, stop, have a chat break etc).

Figure 8 Visual Instructions, signalled by the facilitator's bumper car moving onto the appropriate symbol.

5.2.2 'Overview' versus 'close-up' view: a personal choice

The map view was used only in the two *group formations* experiments with five and eight participants respectively. In the rest of the experiments the close-up view was sufficient since we had a fixed space for each activity, dictated by the background image (e.g. Pong field). The map is a significant part of the original game design, aiming to promote scalability and a sense of group presence. Most people in both experiments used the map view, but stayed most of the time in normal view. We should mention that because we had small groups and subsequently small environments, only a relatively small part of the whole view was 'out of range' in the close-up view. So, one could spend time mostly in the normal view, occasionally switching to the map to locate others. The map view eliminated some visual information (the direction of other cars) but provided information missing in the close-up view (all participants' location). Each player's self-view indicated driving direction with a small arrow, but steering was a bit more difficult in the map view because of the small angle. Two people from the *group formations* experiments (out of twelve in total) commented in the questionnaire that it was not very convenient to use the map all the time and they preferred switching between views. One participant, however, said that he stayed in the map view all the time as he found it easier to move around and see where all the people are. Questionnaire responses on the use of the map from those two experiments indicated that using one view more than the other is, to a large extent, a matter of personal preference.

5.2.3 It is possible to make assumptions about participants' behaviour expressed visually

The aforementioned example of the individual who started something, which was then copied by others, illustrates the importance of group dynamics and individual contributions in every situation. With different people we might get different behaviours and interactions. Skills (driving in games, gaming experience, chat) and personality attributes (e.g. self-assumed leaders) are very relevant and can influence the experience the group will have. Although communication channels are restricted in the game, events are 'open' to interpretation and it is even possible to attribute certain qualities to people by observing their behaviour, expressed through *colour* and *movement* in relation to others. One can observe individual performances and make assumptions about others' innovation, creativity, ability to collaborate and leadership. In our example, our participant seemed to undertake a leadership role: he tried to take the lead by showing his driving skills and initiating patterns. Occasionally, when people did not notice or follow his patterns he would start bumping them as if punishing them! Alternatively if he received no response at all, he would sometimes join the opposite team. Other people tried to attract others' attention in different ways: for example, a participant in the second *group formations* experiment said that he changed to a different colour every time there were two dominant colours to see whether others would follow him. It was also possible to spot individuals collaborating, allowing others to lead, but providing effective support. Another case was

that of people who worked well together as a team. For example, two participants in the first *group formations* experiment performed many coordinated chases together, waiting for one another, and also came up with the aforementioned creative 'victory dance' pattern. After the first *colour jam* experiment, a participant identified different roles among other participants he encountered for the first time in the game: listeners, leaders, organizers and 'messabouters', providing interesting comments for each category. Other people also made comments about other participants who they did not know personally and discussed their behaviour in the follow-up feedback.

Therefore our experiments revealed an interesting dimension: if it would possible to identify some aspect of people's personality and social skills through simple games, then these could be used in different contexts, for example, as a team building exercise.

6. EXTENDING DESIGN PRINCIPLES BASED ON CASE STUDY OBSERVATIONS

Based on the three design principles we discussed earlier in the paper, our experiments and observations allow us to elaborate and extend these, as discussed below.

6.1 Facilitating freedom of expression and creativity

Further to our guiding principle that online groups can self-organise (section 2.3), we have found that we can only *facilitate* spontaneous collaborative play rather than *evoke* it in online environments. We found that the factors below have been significant in our experiments in steering unplanned individual and group playful activities:

The presence of some kind of authority or rules which players can challenge or subvert. In our experiments there was a facilitator coordinating the start and end of the session and certain other phases. While not exactly an authority, the facilitator can be seen as a 'schoolteacher' in the playground space, a person who can be challenged. The existence of simple rules that people can break or subvert (e.g. no bumping others, no talking) often evoke interesting behaviours. Breaking rules (e.g. all the 'messing about' we recorded) can be fun, a sort of 'illegal' entertainment, as long it doesn't continue for too long and disrupt other people's activity. In other words, the system or game could *allow* the user to break the rules in some way. For example, if the rule is to stay for some time in a parking space, a player can break this rule by moving about. This is how a whole meta-game started with those parking spaces, reminding us of 'musical chairs'. In other contexts though, it can be hard to draw the line between allowing people to have fun by breaking the rules and completely disrupting a group activity by being a 'rogue'.

If breaking the rules is not particularly desirable, the environment should at least provide some tools for people to use creatively. So, another alternative is to provide for *freedom of expression: the ability to experiment, do other things beyond an assigned activity, which are integrated in the design.* This is perhaps the most important ingredient. In our case, colour, movement and the ability to collide with other players immediately generated a fun element. Imagine if, instead of static lists of names and dots in an Instant Messaging application, you could do the same as in Bumper Cars, what would happen?

6.2 More presence information

Our experiments confirmed that presence is symbolic and it is crucial (section 2.1). A few breakdowns in coordination among players occurred, illustrating how vital it is to know other people's attention and mental state ('Where am I really?'). For instance, one participant reported in a follow-up discussion that he stopped playing the game for several

seconds when someone came to his desk to talk to him. People in the 'playground space' could not notice the player's lack of participation immediately. Video analysis revealed that a collaborative attempt failed because that person was 'idle'. Our conclusion is that *knowing others' attention/ idleness* is vital for collaboration, particularly in non verbal environments. In our games, an automated 'attention state' would be valuable, for example when a user doesn't press any keys for *several seconds*, their car could become 'grey' or fade gradually. At the same time we suggest that the 'attention' state should also be user-defined, so that the user can turn to 'idle' mode with a quick key press. In this way, if I am just going to pick up the phone or get a sandwich, I can quickly change my state to let others know I am unavailable.

But presence is not just about attention. There are different aspects of a person's 'mental state' that can be crucial in the context of such games and that need to be conveyed symbolically. We have identified *team membership, intention and activity* (e.g. current direction of movement) as important states. Our existing design uses colour to communicate team membership, but further enhancements are required to facilitate team coordination as well as to maintain consistent teams. So, for example, in group formations we can provide users the facility to highlight their target for others in their group to see (*intention*).

In accordance with our design decision to provide just enough experimental space for people to explore and interact spontaneously, we feel that, as a general principle, presence information should be as simple as possible but sufficient for *awareness of other's activity*.

Awareness of individual innovation is also important. All emergent group behaviours we discussed earlier started with the innovation of one or more individuals, followed by many others. Complex patterns and 'rogue' behaviours had to start somewhere before spreading. Then, people would follow after watching others doing it. It is important that people can draw attention to themselves and make others aware of their activity. This needs to be taken into account in the design, especially as we scale up user participation. Rather than lose ourselves entirely in the crowd, we should be able to notice differences in the performance and behaviour of others. Every individual's presence distinguishes him or her from others.

6.3 Large scale visualizations need enhanced visual aids and functionality

Our observations suggest we need to do more than provide 'good visualizations' (section 2.2). In particular, we are considering some additional visual aids for the map view in our environment. Participants mentioned that interacting with others in the map view was more difficult because it was not possible to see other players' direction of movement. In a future version, we would provide visual aids (lines or arrows) to show direction of movement for every player, not just for the user. We would then need another, more explicit way to identify the user's car quickly (e.g. a circle). We are aware of the trade-off between advanced functionality and complexity, so the most appropriate design would depend on the context of the game and perceived scalability. For instance, a game for hundreds of participants would benefit from a rather abstract map view, whereas a game designed for a few tens could have a more detailed map view to cater for local interaction as well. We believe that switching between views may work as a better design solution than having a typical small radar screen at the corner of the interface as in many Massively Multiplayer Role Playing Games (MMRPGs). The reason is that the full map view creates a more immersive sense of a group presence, knowing 'who is there with me' and moreover, it is more scalable as the number of participants increases.

6.4 Online group interactions require a context and appropriate feedback

This is an additional design principle that we are including, which derived from the results of our studies. We found that it is not sufficient to put a group of people together; there needs to be a specific reason for being there or an activity to which everyone can relate. So, the following are fundamental ingredients for future social games, aiming to foster group interactions online:

a) A context. This can be a specific goal, as in our Pong game, where we had two teams and each was defending one side of the screen. However, unlike most computer games, the context of interaction need not necessarily be defined by a goal; it can be open-ended, much like unstructured play in the school playground. Whether bumper cars, Pong or rhythmic colour change competition, it is important that people are able to associate the online collaborative activity with a real life experience, for example with a music jam session.

b) The ability to perform certain acts within the context. People expect to participate in some way in an online environment; in our example, using movement, colour change, following others, chasing others, bouncing off etc. In real life when people gather to socialize for example, they talk to others, make gestures and use body language.

c) Feedback: both individual and group. Our participants emphasized that they needed more feedback from the game and from other participants in response to what they were doing. This feedback was necessary both at the level of *confirmation*: 'am I doing the right thing? Is that player still with me? What are we doing now' as well as for *competition*: 'who or which team is better?'. The first level of *confirmation* can be addressed by introducing contextual presence states, communicating team membership, intention and activity, as mentioned above. A reward mechanism, for both individual's and team's performance, can satisfy the need for *competition feedback.*

6.5 Leverage social skills

This is the second additional principle, based on our observation that it is possible to make assumptions about people's behaviour through simple presence based games. Overall, we have been fascinated by the potential of spontaneous social play and meta-games. As we saw in our experiments, there were several occasions when people used their presence in the game in a creative way, as a means of expression. In these situations, one could notice differences in the behaviour of complete strangers, even without verbal communication (e.g. team player, lurker, innovator etc).

Such playful experiences appear to be beneficial for community development, with the aim of creating and enhancing bonds among isolated individuals. They could potentially help online participants to identify good team players and establish a point of reference for people to meet and get to know each other. We believe that future designs of presence based games should leverage social skills by providing means of personal expression and collaborative activities.

7. CONCLUSION

In this paper we presented our studies in the design of games aiming to facilitate emergent group behaviours online. We outlined our goal to bridge the immediacy of online symbolic presence as in Instant Messaging environments with the unpredictability and engagement of spontaneous, playground-like social play. Our experiments illustrated how play based on presence, as simple as 'being there', and symbolic visual cues (e.g. colour-based team membership) can bring about more complex social behaviours (e.g. clustering, swarms, seeking protection in larger teams, 'group hug', 'dancing' in a pattern). Our participants enjoyed these

spontaneous group interactions and their self-organising performances, whether within or beyond the game context. We also saw how one could make assumptions about participants' behaviour, in a minimal 2-D bumper car environment, with no verbal communication, only colours and movement.

One of the greatest challenges for designers of collaborative and community support systems is to cater for the vitality and spontaneity of human interaction. We believe that play, as a fundamental aspect of human nature, can illuminate some of these issues and help us learn from the 'playground'. We hope that the results from our experiments and in particular, our design elements for emergent play and collaboration will inspire designers of collaborative systems and multi-user environments. We believe that playground experiments of this kind can also be applied in non game related contexts, for example for community building in distance learning environments or team building among small groups. In future work we plan to scale up our experiments to potentially hundreds of participants, en route to further order-of-magnitude increments. Our ambition is ultimately to demonstrate that our findings with small groups will scale up, and that emergent participatory play can spread the feel-good factor of 'being together' among distributed individuals in large online communities.

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APPENDIX

We include the questionnaire we used for the *group formations* game sessions as an example below:

QUESTIONNAIRE

Name: Date:

1. EXPERIMENT DESIGN EVALUATION

1.1 What difficulties did you have with the technical requirements (installation etc) for the game?

1.2 What difficulties did you have with the testing phase (practice session) before the experiment?

1.3 What did you find difficult to understand or confusing in the instructions on how to play this game?

1.4 What problems did you encounter during the actual experiment session?

2. PLAY SESSION EVALUATION

2.1 Did you use a SIGNAL (colour flash) to make others follow you?

If yes, what difficulties did you have when trying to make people follow you by making a SIGNAL?

2.2 What other alternative did you try when the SIGNAL wouldn't work? Did that work?

2.3 What difficulties did you have when following other people?

2.4 How many members did the largest group you participated in have?

2.5 What difficulties did you have to keep up with a group while chasing a target?

2.6 Which group worked best for you when trying to chase a target together:

a) A group with 2 members
b) A group with 3 members
c) A group with 4 members
d) A group with 5 members
e) Other (please specify)

Why?

2.7 What did you find boring?

2.8 What did you find frustrating?

2.9 What did you find fun?

2.10 For which purposes did you change your colour in the session?

For example:

a) To team up with someone in particular
b) To abandon a team
c) To become the same colour as your 'hunters'
d) To challenge people to chase you
e) To be part of the majority

f) Other purposes (please specify)?

2.11 Did you use the map view (which comes when pressing the 'M' key)?

If yes, for what purpose?

2.12 Which view did you use more, the map view or the normal (close up) view?

2.13 Did you try any group formations to 'trap' your target? Please describe what you did.

2.14 What would have helped you to have a better sense of who is in your team?

2.15 Any additional comments

3. PERSONAL INFORMATION

3.1 Gender (underline appropriate): Female Male

3.2 Age group (underline appropriate):

20 – 25 26 – 30 31 – 35 36 – 40 41 – 45 46 – 50 51- 60 61 – above

3.3 How often do you play computer games (underline appropriate):

Never Have played a few times Occasionally At least once a week Everyday

3.4 If you play computer games on a regular basis, approximately how many hours per week?

3.5 What kind of computer games do you play (if any):

3.6 Preferred platforms, devices for playing games (if any):

3.7 How often do you use Instant Messaging (IM) applications (e.g. ICQ, MSN, Yahoo Messenger, Jabber etc) (underline appropriate):

Never Have tried IM at least once Occasionally At least once a week Everyday

3.8 What do you use Instant Messaging for (if you use it)?