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CSCP

Steve Benford, Gail Reynard, Boriana Koleva,
Chris Greenhalgh and Mike Fraser
The Mixed Reality Laboratory, The University of Nottingham

Abstract

Play, not work, is set to become the driving force for collaborative technologies! We explore the topic of CSCP, where the 'P' stands for play (and in our own work also for public and performance). We review four past examples of staging public performances in collaborative virtual and mixed reality environments. We then reflect on the pros and cons of staging public performances as a research method and on whether CSCP should be part of the broader future of CSCW.

1 Introduction

In the mid-1980s when the term CSCW was first coined, the world of computing was very different from today. Organisations were beginning to move from shared mainframe systems to networks of personal computers; platforms for a new kind of software called groupware. Research laboratories were beginning to explore the integration of video and audio with data to create multimedia applications that would allow people to hold meetings at a distance. It must have seemed that collaboration in the workplace would be the primary focus for computer support.

As it turned out, the spread of computers had much broader implications. By the turn of the century the workplace was no longer the sole focus for computer support. Artists and performers were finding creative new uses for computers (as they had been since the 1960s). The games industry had gown bigger than Hollywood. Computer generated movies were commonplace. Children's toys contained embedded computers and could communicate wirelessly. Computers had spread into the home, into schools, into shops, even onto the person. A new focus had emerged – play. Playing (not working) was now the driving force behind the development of the PC – why else were all those 3D graphics cards needed?

So why CSC**W**? Isn't it time to take play more seriously?

2 'P' is for Play, Public and Performance

In this paper, we explore the topic of Computer Supported Cooperative Play (CSCP). This exploration will draw heavily on our own experience of CSCP. We have been using collaboration technologies to stage public performances since 1996. This has involved working with artists, television companies, poets and theatre groups to create real-time participatory experiences that involve

members of the public alongside actors. These have been based on the technologies of collaborative virtual environments (CVEs) and collaborative mixed realities. They have been deployed in a wide variety of settings including theatres, galleries, warehouses, over the Internet, in our laboratory and on city streets. We have also evaluated these performances in order to feedback into the design of new platforms and interfaces. For a more detailed exploration of this approach, the technologies involved, and the issues raised, please see (Benford, 2002).

3 Examples of public performances

We begin by reviewing four examples of public performances, drawn from our previous work.

3.1 Out of This World

The concept of inhabited television combines CVEs with broadcast TV to create a new medium for entertainment and social communication. The defining feature of this medium is that an online audience can participate in a TV show that is staged within a shared virtual world. A broadcast stream is then mixed from the action in the virtual world and transmitted to a conventional viewing audience.

Out of this World (OOTW) was a public experiment with inhabited TV that was staged in front of a live theatre audience (Drozd, 2001). Our aim was to see whether we could produce an experience that was coherent and engaging for both participants and viewers. The event was staged as part of ISEA: Revolution, a programme of exhibitions and cultural events that ran alongside the 9th International Symposium on Electronic Art – ISEA'98 – that was held in Manchester in the UK in September 1998. There were four public performances of OOTW in the Green Room theatre over the weekend of the 5th and 6th of September. These were preceded by two days of construction, testing and rehearsal.

OOTW involved eleven participants: eight members of the public who were selected from the paying audience for each show, divided into two teams and who used desktop PCs; two teamleaders, played by actors who used immersive interfaces; and a host, who was represented as a live video texture. There was an open audio channel between all of these participants. The teams played a series of five games involving interactions with virtual objects and quizzes. Figure 1 shows a scene in which a member of the 'robot' team is lifting their leader into the air to 'harvest fish from the sky' (the opposing 'alien' team is in the background).

OOTW was implemented using the MASSIVE-2 system. Behind the scenes, four virtual camera operators captured views of the action that were then mixed by a professional TV director before being shown to a live theatre audience. One crewmember, the 'world manager', was able to dynamically introduce movement constraints (invisible and potentially moving bounding boxes that limited participants' movements) in order to take participants to set locations at key moments.

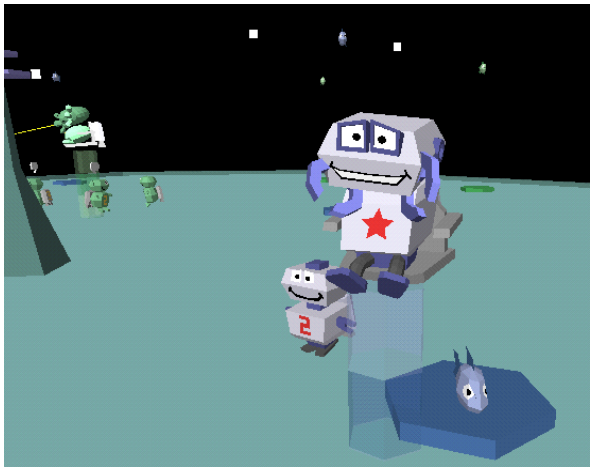

Figure 1: harvesting fish from the sky in OOTW

Evaluation of OOTW involved discussions with theatre audiences, ethnographic studies of behind the scenes activities, and statistical analysis of system logs. The main findings focused on three issues. First, discussions with participants suggested that OOTW was coherent for both players and viewers. The combination of movement constraints and virtual cameras enabled the crew to keep the action moving and to produce a TV-like rendition of it. However, viewers did not engage emotionally with the characters and roundly criticised us for adopting a clichéd linear gameshow format. Second, ethnographic studies of coordination between camera operators and the TV director led to new proposals for semi-automated virtual cameras (Drozd, 2001). Third, the analysis of system logs revealed significant correlation of activity, especially talking. For example, there would typically be nearly ten minutes of a forty-minute show during which all participants were speaking (or shouting) at the same time (Greenhalgh, 1999). This observation contradicts a commonly held view among network engineers that there are typically only one or maybe two simultaneous speakers in a real-time audio application (Schulzrinne, 1996). In turn, this led to new proposals for audio mixing architectures that could cope with the high volumes of network traffic generated by many simultaneous speakers.

3.2 Avatar Farm

Avatar Farm was a second experiment in inhabited television that attempted to address some of issues raised by OOTW, especially the feedback from viewers criticising its format and content.

The overall goal of Avatar Farm was to create a more sophisticated non-linear drama in a virtual world, based upon improvised dialogue between members of the public and professional actors. We recreated four virtual worlds from an online community called The Ages of Avatar in the MASSIVE-3 system. We then invited four active members of the community and seven professional actors to join us in our laboratory for a weekend to create and record an inhabited television show. The resulting drama was staged as four chapters, each of between twenty and thirty minutes duration.

In chapter one, the four members of the public – the players – were reawakened in the familiar worlds to find that their original creators, the feuding gods Virbius, Egeria and Attis, were back in residence, along with their various sidekicks. The players were split up, taken to different worlds, and were recruited or forced into the service of the gods. Chapter two involved the players learning about the nature of the worlds, especially how to gain special powers such as flying, changing appearance, and becoming invisible. They also learned how to trigger a "time rift" – a ghostlike playback of a scene from the past (part of a backstory that had been recorded by the actors on previous days). In chapter three, the players' loyalties to one another were tested and they began to rebel. Further time-rifts revealed more of the history of the feud between the gods. Finally, in chapter four the players overthrew the villains of the piece.

Our four players used standard desktop PCs, as did five of the seven actors. The remaining two actors used immersive interfaces with head-mounted displays (HMDs) so as to give them more expressive avatars. Members of a production crew were also present in the worlds, although invisible. Each player was followed by an invisible stagehand who could invoke special effects and grant them powers. A storywriter and dramatic director, assisted by an artistic director, were provided with an interface to monitor the action in the worlds and to pass instructions to the actors and production crew. In this way, they could adapt the story on the fly, sending the actors into the world with appropriate instructions.

In contrast to OOTW, Avatar Farm had a highly non-linear form. The core of the story was based upon the four players' experiences. For much of the time they were separated and involved in parallel scenes, often taking place in different worlds.

The key technical innovation behind Avatar Farm was a technique called temporal links that enables us to make 3D recordings of sessions in CVEs and then replay them back in a live CVE at a later time (Greenhalgh, 2000). The result is that live avatars can experience scenes from the past, can move around to view them from any angle, and can discuss them while on-line. There were several uses of temporal links in Avatar Farm. First, the story involved several flashbacks in which the players and actors triggered the replay of backstory scenes that had been recorded on previous days and that appeared as ghostly time-rifts (see figure 2). Second, Avatar Farm was itself saved as a series of 3D recordings so that it could be reviewed at a later time on a range of different interfaces.

The 3D recordings and the table-top projection system also supported ethnographic analysis of Avatar Farm. Whereas previous ethnographic studies of CVEs had relied on capturing the viewpoints of different characters on video (meaning that only one or two viewpoints could be examined), we were able to review the whole experience at leisure, adopting any viewpoint that we required. We were also able to alter the recordings to reveal more information. For example, we made the invisible stage-hands visible and then replayed the recordings to see how they had worked together. This revealed a number of problems, mostly arising from the fact that the stage hands could not see one another and so could not easily coordinate their actions. In turn, this led to proposals for making greater use of subjectivity in CVEs (Drozd, 2001). This provides a powerful example of staging a public event, capturing it in detail, and then drilling into the data in order to explore different issues that were not known or predicted in advance.

Figure 2: live avatars watch a ghostly 3D flashback

3.3 Desert Rain

The focus of our third example, Desert Rain (Koleva, 2001) was different again. This time, our aim was to explore issues surrounding the design of mixed reality performances that blur the boundaries between the virtual and physical.

Desert Rain was developed as joint venture with the performance art group Blast Theory (www.blasttheory.co.uk). It was a combination of performance, installation and computer game. Six players at a time were sent on a mission into a virtual world to find six human targets. They explored motels, deserts and underground bunkers, communicating with each other through a live audio link. Once in the virtual world, they had twenty minutes to find their allocated targets, complete the mission, and get to the final room, where the identities of the targets were revealed.

The central artistic concern of Desert Rain was virtual warfare, the blurring of the boundaries between real and virtual events, especially with regard to the portrayal of warfare on television news, in Hollywood's films and in computer games. Both the content and the form of Desert Rain were designed to provoke participants to reevaluate the boundaries between reality and fiction, and between the real and the virtual.

The key feature of Desert Rain was the way in which the virtual world was integrated into an extensive physical set. The experience began in an antechamber where the players donned special clothing and were briefed as to the nature of their mission. A player accessed the virtual world by being zipped into an individual fabric cubicle (see figure 3), where they shifted their weight on a pressure sensitive footpad in order to control a viewpoint that was projected onto a rain curtain, a two meter square curtain of water spray. The rain curtain further blurred the boundary between physical and virtual as it allowed performers and players to physically step through it, establishing the illusion of crossing into and out of the virtual world. Finally, at the end of the experience, the players moved on to a physical room that was a facsimile of one of the rooms in the virtual world.

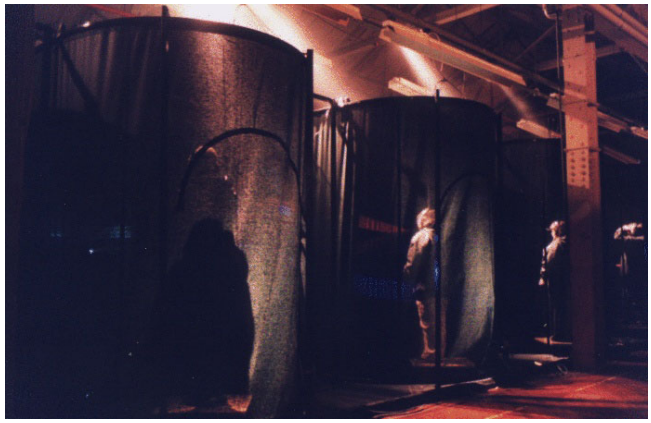

Figure 3: players zipped into their fabric cubicles

Of all the experiences described in this paper, Desert Rain was the one that most successfully lived as a professional work. It emerged from a long period of development that began in the summer of 1997 to begin touring as a polished product in October 1999. It has since toured venues throughout the world including Nottingham, Karlsruhe, London Bristol, Glasgow, Rotterdam, Prague, Stockholm and Sydney.

This extensive touring schedule provided a unique opportunity for study. We carried out ethnographic studies of Desert Rain as it toured, focusing on the issue of orchestration; the process of shaping on-going experience from behind the scenes in order to ensure that a participant's engagement with content is not fractured (Laurel, 1992) Our studies shed light on two key aspects of orchestration. First, was the way in which performers and crew monitor activity in both virtual and physical spaces. This was achieved through the use of displays that tracked different players' viewpoints, listening in to the audio channel, and by exploiting the asymmetric nature of the rain curtain (it is transparent from behind, providing an opportunity to observe users without being observed). Second, were the different ways in which performers intervened in physical and virtual spaces in order to shape a player's experience and to resolve problems. Off-face interventions involved carefully weaving instructions to the players into the performance (e.g., using the audio channel). Virtual interventions involved carefully steering the players through the world (ideally) without them knowing. Finally, face-to-face interventions were a last resort in which a performer would have to directly engage a player directly in order to resolve a problem.

3.4 Can You See Me Now?

Our final example, Can You See Me Now?, extended our work with mixed reality performances by moving outdoors onto the city streets. Can You See Me Now? was a game in which up to twenty on-line players were chased across a map of a city by three performers who were running through its streets (www.canyouseemenow.co.uk). Our motivation was to explore issues in the deployment of mixed reality technologies outdoors, and to understand the kinds of collaborative relationships that are possible between online participants and those on the streets.

Can You See Me Now? was created in collaboration with Blast Theory, and was staged in the city of Sheffield as part Shooting Live Artists 2001, a series of new media events supported by the Arts Council of England, BBC Online and b.tv, the media company.

Central to Can You See Me Now? was a relationship between up to twenty on-line *players* (members of the public using the Internet) who were moving across a map of Sheffield, and three *runners* (members of Blast Theory) who were moving through the streets of Sheffield. The runners chased the players. The players avoided being 'seen'. Everyone, runners and players, saw the position of everyone else on a shared map. Players sent text messages to each other, which were also received by the runners. In turn, runners talked to one another over a shared radio channel, which was also overheard by the players.

Figure 4 shows an example of the player interface. A simple white icon showed the player's current position according to their local client. Other players were represented as blue icons. The runners were shown as orange icons.

Figure 4: An on-line player's Interface

The runners also saw the map of Sheffield showing their positions as well as the players' positions and text messages. This was delivered to them on a Compaq iPAQ from a server in a nearby building over a 802.11b local area network. A GPS receiver plugged into the iPAQ registered the runner's position as they moved through the streets and this was sent back to the server over the wireless network via an armband antenna. The runners also used walkie-talkies with earpieces and a head-mounted microphone.

The performance was orchestrated from a control room in Sheffield. This hosted the game server, the connection to the 802.11b network (via a high-power omni-directional antenna on an eight meter mast on the roof), the connection to the Internet, and interfaces for monitoring GPS and 802.11b signals from the players.

Can You See Me Now? was live for 6.5 hours during the weekend of Friday 30th November and Saturday 1st December 2001. 214 players took part over the Internet. 135 of these were caught, 76 logged off and 3 were never caught. The best 'score' (time without being caught) was 50 minutes. The worst was 13 seconds.

Evaluation based upon audience feedback, ethnographic studies and analysis of system logs (including statistical analysis of players' movements and manual analysis of logs of text messages), raised a number of issues, grouped around the themes of gameplay and orchestration. Gameplay

issues focus on participants' experiences of the game, their tactics, and ways in which the game could be improved.

4 Is CSCP part of the future of CSCW?

Having reviewed some public examples of CSCP, we finish this paper by reflecting on two broader questions. First, what are the pros and cons of public performance as a research method? Second, is CSCP part of the future for CSCW?

For the first question, there are many valid ways of conducting research into new technologies: theory backed up with mathematical proof, implementation as proof of concept, controlled experiments in the laboratory, and "demo or die" to name a few. The approach of staging public performances involves taking emerging technology out of the laboratory and working with professionals to create an event that can be placed before the public. This can be a time consuming and expensive process: the technology has to work and large volumes of equipment may have to be moved, rigged and de-rigged, requiring the support of a production 'crew'. Why go to the lengths of staging a public performance? We see several distinct advantages to this approach: the discipline of focusing on the details; studying technology in situ; performance providing a creative playground for new technologies; engaging the public in the research process; drawing on the skills of artists; and addressing potentially important markets. However, there are also drawbacks to this approach including: its expense and often being an uncomfortable fit with traditional research planning and funding models. It is also difficult to make something that is both artistically and technically groundbreaking (more generally, interdisciplinary researchers often suffer from the expectation that they will be excellent at several disciplines).

Now to the second question: is CSCP part of the broader future of CSCW? We believe so. Playful uses of computers seem set to expand and collaboration – playing together – is an important feature of play.

If CSCW does take on board CSCP, how will it adapt its research focus and methods? Through our examples, we have attempted to highlight some emerging research issues as well as the potential benefits and drawbacks of the approach of staging and evaluating public performances.

With the worldwide markets for on-line and wireless gaming estimated to grow to billions of dollars, we believe that CSCP (but almost certainly under different names) will continue to grow in importance as both a research topic and a commercial activity. The question is where will the CSCW community be? Will it be center-stage, contributing its knowledge, skills and expertise, creating and studying a new generation of collaborative technologies? We hope so.

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Contact Information

Steve Benford, Gail Reynard, Boriana Koleva, Chris Greenhalgh, Mike Fraser
The Mixed Reality Laboratory
The University of Nottingham
Nottingham NG8 1BB, UK

{sdb, gtr, bnk, cmg, mcf}@cs.nott.ac.uk