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Overview of 2nd International Workshop on Presence, 6-7 April 1999, Colchester, England

Michael Meehan
Jonathan Freeman
Wijnand IJsselsteijn

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Michael Meehan
University of North Carolina
U.S.A.

Jonathan Freeman[1]
Goldsmiths College, University of
London
U.K.

Wijnand IJsselsteijn
IPO - Center for Research on
User-System Interaction
The Netherlands

Contact:
Michael Meehan
Computer Science Department
University of North Carolina
Chapel Hill, North Carolina 27599-3175 U.S.A.
(919) 962-1979, Fax: (919) 962-1799
meehan@cs.unc.edu

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[1] At the time of the workshop Jonathan Freeman worked at the University of Essex.

On the 6th and 7th of April 1999, the 2nd International Workshop on Presence was held at the University of Essex. The event was organized by Jonathan Freeman (Goldsmiths College, University of London) and Wijnand IJsselsteijn (IPO, Center for Research on User-System Interaction) as part of the European Commission ACTS TAPESTRIES project. The TAPESTRIES project was managed by the UK Independent Television Commission (ITC) and the workshop was sponsored by SONY, BT, and the ITC. The workshop program is followed by a brief introduction to presence and then by short summaries of each of the papers.

Tuesday, 6th April 1999

Welcome, Introduction and Guest Speakers
Welcome and Introduction
Nick Lodge, Independent Television Commission, UK
Co-Presence as an Amplifier of Emotion
Mel Slater, University College London, UK
Across Media: Toward a Standardized Conceptual and Operational Definition of Presence
Matthew Lombard, Temple University, USA;
Theresa Ditton, Villanova University, USA
Queries into Presence
Stephen R. Ellis, NASA Ames Research Center, USA

Presence - Structure and Measurement
Decomposing the Sense of Presence: Factor Analytic Insights
Thomas Schubert, Frank Friedmann, University of Jena; Holger Regenbrecht, Bauhaus University of Weimar, Germany
The Scope of Presence
John A. Waterworth, Department of Informatics, Umea University, Sweden
Critical Ratios as Behavioural Indices of Presence
Pieter Jan Stappers, Delft University of Technology, The Netherlands; John M. Flach, Wright State University, USA; Fred A. Voorhorst, ETH Zurich, Switzerland
Presence through Advanced Broadcast Services - TAPESTRIES Review
Jonathan Freeman, Steve E. Avons, University of Essex, UK; Wijnand IJsselsteijn, IPO - Center for Research on User-System Interaction, The Netherlands; Huib de Ridder, Delft University of Technology, The Netherlands
Presence and the Content of Virtual Environments
P.C. Fencott, University of Teeside, UK
The Visual Cliff Revisited: A Virtual Presence Study on Locomotion
Martin Usoh[1], Kevin Arthur[2], Mary Whitton[2], Rui Bastos[2], Anthony Steed[1], Fred Brooks[2], Mel Slater[1]
([1]University College London, UK; [2]University of North Carolina at Chapel Hill, USA)

Wednesday, 7th April 1999

Presence and Performance: Presence and Communication
Presence in Multimodal Interfaces
Eva-Lotta Sallnas, Interaction and Presentation Laboratory, NADA, Sweden
Trust in Shared Virtual Environments: The Example of Active Worlds
Ann-Sofie Axelsson & Ralph Schroeder, Chalmers University, Sweden
Participatory Immersive Drama - A Media Paradigm for the Next Century
Sharon Springel, Cambridge University, Centre for Communications Systems Research, UK
Broadcasting Digitally Generated Gameshows
Riccardo Antonini, University of Rome "Tor Vergata", Italy

Presence and Performance: Presence and Learning
Some Topics Concerning 3D Virtual Environments for Learning and the Concept of Presence,
Nuno R. P. Otero, University of Sussex at Brighton Falmer, UK
Understanding the Role of Presence in Virtual Learning Environments
Denise Whitelock and Anne Jelfs, Open University, UK
Between Real and Unreal: Investigating Presence and Task Performance
Katerina Mania, Hewlett Packard Labs, University of Bristol; Alan Chalmers, University of Bristol, UK

Technical Presentations Related to Presence
Investigation of Sheet Bending Using Mass-Spring Systems within a Virtual Environment
B. S. Mahal, D. E. R. Clark, J. E. L. Simmons, Herriot-Watt University, Edinburgh, UK
MAX: Teleoperated Dog on the Web
Alexander Ferworn, Rick Roque, Ivan Vecchia, Ryerson Polytechnic University, Toronto, Canada

Introduction

Presence is defined as the subjective sensation of "being there" in a mediated environment. Much of the presence research completed to date has been in relation to Virtual Environments (VE) as they can evoke in participants a compelling sense of presence. Presence research is also relevant to non-interactive broadcast based display systems, such as 3D, high-definition, or immersive TV. With these systems a strong sensation of "being there" in the depicted scene can also be elicited.

Formal research into presence is at an early stage since the technological developments required to generate the sensation are recent. However, several research questions have been addressed to date. A number of papers have demonstrated that a range of display parameters can affect participants' sensations of presence. These display factors include, but are not limited to, interactivity, pictorial realism, stereoscopic presentation, field of view, haptic feedback and spatialized sound. Other research has shown that factors relating to individual participants, such as prior experience and personality, can also influence presence. To date there is no single, accepted paradigm for the assessment of presence and, while post-test subjective ratings have often been used in the research published to date, the search for an objective measure to corroborate subjective ratings remains active.

A key question on which several of the workshop papers touched relates to the utility presence. Researchers using VEs for training and simulation hope that "high presence" environments enhance the transfer of learning to the real world; while others hope that presence enhances task performance. Broadcasters and researchers using VEs for entertainment hope that "high-presence" display systems enhance the impact of a presentation, or the arousal and enjoyment arising from it. Methods of measuring presence and its utility are important issues, and the quality of the research presented at the workshop indicates that substantial resources are being directed towards addressing them.

The 2nd International Workshop on Presence aimed to provide an informal setting for researchers in the area to meet one another and to present and discuss their latest research. The workshop brought together researchers working with both VEs and broadcast display systems and proved to be a useful and encouraging snapshot of the current state of presence research. Judging by the extent of the informal discussion, the workshop succeeded in its goals.

What was said

Nick Lodge's welcoming remarks were followed by Mel Slater's invited talk describing UCL's recent work on co-presence: the sense of being there with others. The use of VEs for the treatment of phobias has often been suggested and several research groups have been investigating this application. Mel's research group is currently working on treating fear of public speaking. Their results show that, among other things, a subject's self-rating of speaking performance is correlated with the reaction of the virtual audience. A disinterested virtual audience resulted in participants rating their performance as less good than did an attentive virtual audience. Positive feedback from a virtual audience might be useful in helping people overcome fear of public speaking. Mel showed a short video excerpt from BBC's Tomorrow's World program which showed a stand-up comedian with stage fright. The clip suggested that he found therapy with virtual audiences useful.

Mathew Lombard gave the second invited talk. He discussed some of the findings of the broadcast community with regard to presence and summarized six conceptualizations of presence found in the literature: social richness (how personable is the interaction), realism (perceptual and plausibility), transportation (of user into another world, or object/people into subjects'), immersion (perceptual and psychological), social actor within medium (involvement or relationship with actors portrayed on TV), and medium as social actor (treating a computer or television as a social actor). Matthew is currently developing a questionnaire, based on the six conceptualizations he presented, to assess presence in different environments (TV, film, and VE).

Stephen Ellis gave the final invited talk. He suggested that in some instances successful communication might be more important than presence. He argued that for presence to be a useful construct for the development of VEs for simulation and training, it must aid performance. Steve also suggested that some of the parameters that have been shown to enhance presence (for example extent of sensory information) do not necessarily optimize task performance - citing displays used for air-traffic control as an example. He also discussed other researchers' views on aspects of presence and raised important questions such as: Is it conserved? Is it divisible? He concluded that for presence to be a useful construct we need to be able to define equivalence classes – keeping presence constant during compensating changes in system parameters such as lag and visual fidelity.

Thomas Schubert began the paper presentations by describing his group's study of presence among (primarily) young male video game players (n=246). Factor analysis of their presence questionnaire produced eight first-order factors: spatial presence (14 questions), quality of immersion (8), involvement (10), drama (7), interface awareness (7), exploration of VE (examining objects) (6), predictability and interaction (6), realness (believability) (5). A second-order factor analysis on the same data revealed three components of the presence construct: spatial presence, involvement and how comparable the environment is to the real world.

John A. Waterworth reported on subjects' abilities to remember information presented as text only, in a virtual spatial layout, or in a combination of the two. They found that people performed best at the opposite ends of the design spectrum (all spatial or all textual – not a mixture of the two) and that presence was highest in the spatial layout.

Pieter Jan Stappers described two experiments that investigated whether behavioral measures could be used to replace, justify, or augment subjective measures of presence. In one study he varied the equations used to determine the trajectory of a virtual ball behaving according to Newtonian, Aristotelian, or Medieval motion theory. He found that subjects could perform equally well regardless of motion theory used in the VE – even though in the real world we experience an approximately Newtonian system. In his second experiment, he used degree of torso twist

when passing through real and virtual doors as a measure of presence. He observed that when passing through a real door, the gap (door) size at which torso twist began was 1.5 shoulder widths and that torso twist was inversely proportional to gap size. In the virtual environment, he observed an incoherent range of torso twisting – probably due to the fact that subjects could not gauge the width of their virtual shoulders. He concluded that presence could be measured by degree of torso twist and other VE-specific behavioral responses, but that these responses would not necessarily correspond with responses to similar stimuli in the real world.

Jonathan Freeman presented an overview of a number of studies dealing with presence evoked by 3D television. These studies were performed as part of the ACTS TAPESTRIES project and were novel because subjects used a hand-held slider to rate their sense of presence continuously (in real-time). In an early experiment observers were required provide continuous ratings of depth, naturalness of depth, and presence for separate viewings of an 8 minute section of stereoscopic video. The extent of sensory information present within the 8-minute video varied continuously. Results of this and several other experiments indicated that stereoscopic and motion parallax cues enhance presence. To address the robustness of their continuous measures they noted that inter-observer variation was small and that similar results were obtained in different labs (IPO and UoE). However, subsequent experiments showed that subjective measures of presence could potentially be biased by previous experience, e.g. rating a different attribute in a previous session. In order to obtain a more stable presence measure, TAPESTRIES researchers attempted to develop objective corroborative measures of presence as adjuncts to potentially unstable subjective measures. For this, the *behavioral realism* approach was adopted. The approach is based on the premise that as a display better approximates the environment it represents, an observer's responses to stimuli within the display will tend to those which he/ she would exhibit to the environment itself. Two paradigms were investigated in this regard: (i) visual proprioception and (ii) postural adjustments to moving stimuli. Visual proprioception was shown not to be a good measure of presence as it was insensitive to stereoscopic presentation (whereas presence has consistently been shown to be enhanced by stereoscopic stimulus presentation). Postural adjustments to a moving video, filmed from the hood of a

rally circling a track, were sensitive to stereoscopic presentation. Postural measures based on this approach hold more promise as a display evaluation measure, although they cannot be taken as direct substitutes for subjective presence ratings as the two measures were not correlated across subjects.

Clive Fencott discussed his experiences during a series of critiqued improvements to his VRML[2] VE. He noted that, in VEs, if things cannot be presented perfectly, they should be presented consistently – that consistency increased believability. From his point of view, content is the goal of perception and VE content designers are designing something that is in the users' mind. Further he proposed that we are accustomed to perceptual clutter and its absence in a VE can make the experience seem unnatural. Increasing the number of tasks increases this clutter – thereby distracting the user from a VE's lack of realism.. He went on to define a framework of possible components in VEs: surprises (doors, animals in the VE), retainers (rooms, etc...), deflectors (stop user from hitting the edge of the world), sureties (basics laws that hold in VE) and shocks (the edge of the world, other things to avoid).

Martin Usoh presented a recent extension of UCL's 1995 research on the effect on presence of different means of locomotion in a VE. In the 45-subject study, means of locomotion was varied among independent groups of subjects (point-and-hold-trigger, walk-in-place, and really-walk-around). Results replicated those of the 1995 study in that a higher association with a virtual body (a participants' representation in the VE) correlates with a higher sense of presence. They also reported that subjects who were engaged in real walking reported higher presence. Finally, Martin suggested that the routes participants took in traversing a virtual pit in the test VE might be good indicators of presence (i.e. if participants avoid "walking" over the virtual cliff, it might be inferred that they are more present).

Eva-Lotta Sallnas discussed her work on the effect of haptic feedback on co-presence. She used fourteen pairs of participants (each comprised of one male and one female) in a between-group design. Each pair performed four collaborative tasks. Half of the pairs could feel the force-feedback of the other; the other half had no force-feedback. All pairs had audio channels with which to

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[2] Virtual Reality Markup Language

communicate. She found that haptic feedback significantly improved task performance. In these experiments, co-presence and presence were measured by self-report questionnaires. Results demonstrated that haptic feedback significantly enhanced presence, but not co-presence. Objective measures of galvanic skin response were also collected but the data has not yet been analyzed.

Ann-Sofie Axelsson and Ralph Schroeder discussed their investigation into trust-development in long-term, large scale VEs – with specific reference to Activeworlds. They noted that trust is essential in society in order to reduce uncertainty in social and business interactions. They observed that there was considerable trust building in Activeworlds: people acted consistently from day-to-day and anti-social behavior was not tolerated (non-toleration was enforced via an ejection mechanism available by petition to the world-master).

Sharon Springel discussed participatory immersive drama. She suggested that society is moving from an authored entertainment paradigm to a real-time, collaborative, authoring/ participation paradigm – citing the internet as the first medium to be produced by its consumers. Sharon presented the concept of *Interactive Immersive Drama* – a system currently under development that will allow users to cast themselves in roles within a unique shared dramatic experience.

Riccardo Antonini discussed the layout and implementation of a virtual game show, now being broadcast in Italy, where participants can interact, in real-time, with the people and events of the show. This was perhaps the clearest demonstration of the benefits of VR and broadcast researchers working together to develop new applications.

Nuno R. P. Otero discussed the relation between presence, attention, and learning in educational VEs. He discussed the need to look at cognitive issues in order to design effective VE learning environments. Specifically, he stated that key points in design should be explicitness and visibility (capacity to direct attention at important aspects), cognitive tracing and interactivity (allowing annotation), and ease of production (ease of construction should imply ease of understanding).

Denise Whitelock and Anne Jelfs discussed their design of an on-line course for the Open University (UK). Denise and Anne reported that in a simulation of a virtual forest, students wanted to use the magic of the computer – for example they wanted cues for finding the animals in the forest. In a second system they have developed, exploring the North Atlantic Ridge, high presence ratings were obtained and the students thought they learned much. Test results did not support the students' confidence. Conversely, in the systems for which low presence ratings were obtained students felt that they did not learn much, but they did. This finding raised the question of whether the novelty of the "high-presence" systems was distracting to students. Clearly, this is an important research issue that requires further study. Interestingly, infidelities in the North Atlantic Ridge system were seen (by students) as adding realism to the simulation. Is this the perceptual clutter to which Clive Fencott was referring?

Katerina Mania plans to further investigate the relationship between presence and learning. She presented some interesting research plans designed to investigate differences between knowledge acquisition among subjects who view a virtual lecture and subjects who experience a real lecture of the same duration, with the same audio and approximately similar visual stimuli. Katerina will hopefully be presenting the results of this study at the 3rd International Workshop on Presence.

Bob Mahal presented a two-layer mass-spring system that more realistically simulates fabric deformation in a VE. Researchers have previously noted that realistic physical behavior of surfaces can contribute to a sense of presence, and it remains to be seen whether Bob's model is widely adopted.

The final paper scheduled for this session, *MAX: Teleoperated Dog on the Web* was not unleashed at this workshop, but delegates were recommended to visit MAX's homepage to control him for themselves.

The workshop concluded with demonstrations of a number of stereoscopic and immersive displays at the University of Essex Multimedia Lab. Finally, an unofficial announcement was

made that the *3rd International Workshop on Presence* will be held at Delft University of Technology in the Netherlands, possibly in connection to CHI 2000 in The Hague (near Delft). Further information and a call for papers will be posted via the regular VR newsgroups and conference lists (e.g. http://vr.edu).

Please see the following links for more information and extended abstracts of the papers that were presented:

1st International Workshop on Presence:

http://vb.labs.bt.com/SharedSpaces/Presence

2nd International Workshop on Presence:

http://privatewww.essex.ac.uk/~jfreem/Presence_Workshop.html

or the mirror-site at IPO: http://iris8.ipo.tue.nl:8090/workshop.html

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