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## SoundScapes – A concept and methodology of "Being There"

Lewis Brooks, Anthony

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The 6th Annual International  
Workshop on Presence



## **Programme Book**

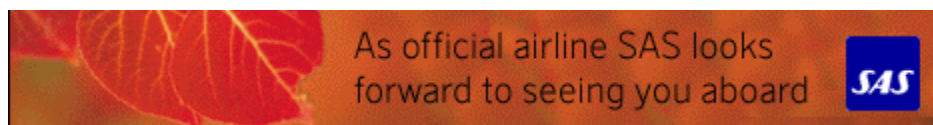
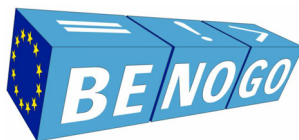
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Salvatore Livatino

Organized in connection with  
IST / FET Presence Research Initiative

## Conference Sponsors



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## Conference Addresses

<http://benogo.dk/presence2003>

### Conference Chair

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## Welcome to Presence 2003 in Aalborg

A warm welcome to all (about 100) participants - in particular to our invited speakers and to contributors of talks, posters and Exhibitions.

PRESENCE 2003 is organized by ISPR, the International Society for Presence Research, and supported by the European Commission's FET Presence Research Initiative through the IST BENOGO and IST OMNIPRES projects, and by Aalborg University.

PRESENCE 2003 has invited academics and practitioners with an interest in research, theory, technology, and applications related to the concept of presence to attend. The goal of PRESENCE 2003 is to bring together academic researchers in the area of media and presence, content and technology developers, and interested commercial parties so they can meet, share experiences, present research, and exchange ideas.

PRESENCE 2003 aims to be a worthy follow-up to the successful previous 5 Annual International Workshops on presence research, but it also aims at joining the established Presence research Community with "newcomers" involved in the IST/FET funded projects.

The hope is to achieve a broader and stronger community.

The list of participants suggests that this may indeed be under way. To further support this we have a programme comprising 2 sessions with invited speakers, 2 OmniPres Symposia sessions, 1 Demo session and 9 sessions with contributed papers – all enclosed by 16 posters and 4 exhibitions.

We hope that this can inspire you to personal engagement through which we jointly can evolve the event into a very fruitful experience.

May you feel happy and present at *Presence 2003* in Aalborg.

Erik Granum  
Conference Chair

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## PRESENCE 2003 Programme Outline

| Monday, October 6   | Tuesday, October 7   | Wednesday, October 8   |
|---|--|--|
| 8.00 Registration<br>Mounting Posters<br>& Exhibitions<br>Coffee  | 9.00 Session 6<br><i>OMNIPRES Symposium 1.1</i><br>Presence Theory and<br>Measurement Models | 9.00 Session 11<br><i>OMNIPRES Symposium 1.2</i><br>Panel: Presence<br>Foundations |
| 09.30 Session 1<br>- Conference Opening<br>- Invited Speaker, Oliver<br>Grau  |  |  |
|   |  |  |
| 10.45 Break   | 10.30 Coffee Break   | 10.30 Coffee Break   |
| 11.00 Session 2<br>Shared Virtual Environments  | 11.00 Session 7<br>Theory & Models   | 11.00 Session 12<br>BIP & Applications   |
| 12.00 Exhibitions & Posters<br>12.30 Lunch  | 12.30 Lunch<br>Exhibitions & Posters   | 12.30 Lunch<br>Exhibitions & Posters   |
| 13.30 Session 3<br>Perception   | 13.30 Session 8<br>Agents  | 13.30 Session 13<br>Measurement Methods  |
| 14.30 Coffee Break  | 14.30 Break  | 14.30 Break  |
| 14.45 Session 4<br>Binaural Sound<br>- Invited Speakers   | 14.45 Session 9<br>Communication   | 14.45 Session 14<br>Emotions   |
|   |  | 15.45 Concluding<br>Remarks  |
| 15.45 Break & "Transfer"  | 15.45 Coffee Break   | 16.15 Coffee & Farewell  |
| 16.00 Sessions 5, Demos<br>A <a href="#">VR Medialab</a><br>(Cave, Panorama,<br>Powerwall)<br>B <a href="#">Dept. of Acoustics</a><br>(3D sound, Binaural)<br>"Switch" places about 16.35 | 16.00 Session 10<br>Perception & Interaction   |  |
| 17.15 Reception at VR<br>Media Lab  | 19.30 Conference Dinner<br><a href="#">Hotel Hvide Hus</a><br>Panoramic Restaurant           |  |

**PRESENCE 2003 Programme****Oral Sessions in Lecture Hall B****Poster viewing in the Foyer during breaks****Exhibition in Lecture Hall C**

(Exhibitions are available throughout the conference)

**Monday, October 6****08.00 Registration Opens*****Mounting Posters & Exhibitions*****09.00 Coffee****09.30 Conference Opening by Conference Chair****09.45 Session 1: Immersion and Presence*****Chair: Frank Biocca******- Invited key note speaker, Oliver Grau, Humboldt University, Berlin*****10.45 Break****11.00 Session 2 : Shared Virtual Environments*****Chair: Frank Biocca*****Beyond Presence and Copresence: A Phenomenological Account of Experiences in Shared Virtual Environments*****Ralph Schroeder*****Is there a Trade-off Between Presence and Copresence?*****Maria Spante, Ralph Schroeder, Ilona Heldal, Ann-Sofie Axelsson*****Facilitating the Presence of Users and 3D Models by the Augmented Round Table*****Erik Granum, Thomas B. Moeslund, Mortiz Störing, Wolfgang Broll, Michael Wittkaemper*****12.00 Exhibitions & Posters****12.30 Lunch****13.30 Session 3: Perception*****Chair: Mel Slater*****Preparing Virtual Streets for the Investigation of Mesopic Vision*****Cecília Sik Lányi, János Schanda*****The Importance of Shadows in Augmented Reality*****C.B. Madsen, M.K.D. Sørensen, M. Vittrup***

**Rendering Quality and User Cognition: An Experimental Study***Katarina Mania, Dave Wooldridge, Andrew Robinson***Effects of Screen Size on Physical Presence, Self Presence, Mood, and Attitude toward Virtual Characters in Computer/Video Game Playing***Kwan M Lee, Wei Peng***14.30 Coffee Break****14.45 Session 4: Basic Principles of Binaural Sound***Chair: Erik Granum***Invited speakers from Department of Acoustics, Aalborg University**

- *Dorte Hammershøj*: Binaural Recording, Synthesis and Reproduction
- *Søren Krarup Olesen*: Room Simulation and Auralization

**15.45 Break & "Transfer"***5-10 minutes walk***16.00 Sessions 5, Demos***(2 groups, change place at about 16.35)***A: VR Media Lab****(Cave, Panorama, Powerwall)****B: Department of Acoustics****(3D sound, Binaural)****- 17.15 Reception at VR Media Lab****Tuesday, October 7****09.00 Session 6, OMNIPRES Symposium 1.1*****Presence Theory and Measurement Models***Description:

Presence research is maturing to the point that attempts to generate more comprehensive models of presence are emerging. In this session various models of presence causes and correlates will be presented and discussed.

Format

Longer format presentations (25-30 minutes).

Active questions from a chair discussant and audience questions

Presentations

Jonathan Freeman, Goldsmith's College

Peter Vorderer, Hochschule fuer Musik und Theater & University of Southern California

Mel Slater, University College London

Chair

Frank Biocca, M.I.N.D. Labs

**10.30 Coffee Break****11.00 Session 7 : Theory and Models**

**Chair: Wijnand Ijsselstein**

**Connectedness, Awareness and Social Presence**

*Ruth Rettie*

**Presence as Perceived Continuity of Experience**

*Richard Walker, Fabrizio Davide*

**The Strata of Presence: Evolution, Media, and Mental States**

*J.A. Waterworth, G. Riva, E.L. Waterworth*

**A Psychological Approach to Presence**

*C. Botella, R.M. Banos, M. Alcañiz*

**When Real Seems Mediated: Anti-Presence**

*Lydia Reeves Timmins, Matthew Lombard*

**12.30 Lunch****13.30 Session 8 : Agents**

**Chair: Matthew Lombard**

**When Low Spatial Ability Does not get you "there" in 3D Environments, but Agent Jump out "Here" to Change Attitudes**

*Frank Biocca, Linda A. Jackson, Lynette Lim, Weimin Mou, Gretchen Barbatsis, Alexander von Eye, Yong Zhao, Hiram Fitzgerald*

**Effects of Interactivity and Expressiveness on Perceived Social Presence, Memory and Persuasion in Interactive Health Communications**

*Hsuan-Yuan Huang*

**Gender Identification with an Anthropomorphic Computer Help Agent: A Social Presence Approach**

*Prabu David, Li Cai, Tingting Lu, Irkwon Jeong*

**Embodied Conversational Agents in E-Commerce. Do they sell?**

*Gary Bente, Heike Blens, Nicole C. Krämer*

**14.30 Break**

**14.45 Session 9 : Communication****Chair: Matthew Lombard****Communication in Virtual Environments: Establishing Common Ground for a Collaborative Spatial Task***Anne-Sofie Axelsson, Åsa Abelin, Ralph Schroeder***On Transmitting Emotions – Experiments on Multimodal Presence over the Internet***Gábor Tatai, László Laufer, Attila Szaló, Annamária Csordás***Evaluation of the VIRTUE Video-Conference System Using the ITC-Sense of Presence Inventory***Jonathan Freeman, Jane Lessiter, Oliver Schreer, Peter Kauff***15.45 Coffee Break****16.00 Session 10 : Perception & Interaction****Chair: Jonathan Freeman****Circular Vection is Facilitated by a Consistent Photorealistic Scene***Jörg Schulte-Pelkum, Bernard E. Riecke, Markus von der Heyde, Heinrich H. Bühlhoff***Using Eye Tracking and Psychophysiological Methods to Study Spatial Presence***Jari Laarni, Niklas Ravaja, Timo Saari***Cue Integration in the Haptic Perception of Virtual Shapes***Knut Drewing, Marc O. Ernst***“Dual” Embodied Interaction for Creating a Virtual Co-existing Space***Shigeru Wesugi, Yoshiyuki Miwa***19.30 Conference Dinner*****Hotel Hvide Hus, Panoramic Restaurant*****Wednesday, October 8****9.00 Session 11, OMNIPRES Symposium 1.2*****Panel: Presence Foundations*****Description:**

Some are concerned that the concept of presence may become overloaded with different meanings and interpretations and that this may impede progress. A major aspect of any mature scientific discipline is a more or less accepted and unified paradigm within which much of normal science, every day research and puzzle solving, takes place (Kuhn). This is not the case with presence research which is a new and maturing area. At this stage there are a variety of different approaches both in terms of definition and methodology. This panel will include speakers presenting different approaches, and in the discussion following, an attempt will be made to see if there is common unifying ground.

Format

Introductory statements by panelists (20 minutes)

Discussion moderated by a chair

Panelists

- Mel Slater, University College London
- John Waterworth, Umea University
- Frank Biocca, M.I.N.D. Labs

Chair

Wijnand IJsselsteijn, Technische Universiteit Eindhoven

**10.30 Coffee Break****11.00 Session 12 : BIP & Applications**

**Chair: Jonathan Freeman**

**More Breaks Less Presence**

*Andrea Brogni, Mel Slater, Anthony Steed*

**Physiological Responses to Breaks in Presence: A Pilot Study**

*Mel Slater, Andrea Brogni, Anthony Steed*

**The Sense of Presence in a Sample of Patients with Neuropsychological Dysfunctions during a VR-enhanced Cognitive Rehabilitation**

*G. Castelnuovo, C. Lo Priore, Di. Liccione, A Gaggioli, G. Riva, Da. Liccione*

**Presence and High Fidelity Patient Simulators in Anaesthesiology: Influences Derived From Interviews and Questionnaires**

*Peter Dieckmann, Tanja Manser, Theo Wehner*

**Should Product Involvement Facilitate the Experience of Telepresence? The Case of a Quasi 3-D Virtual Store**

*Anne-Cecile Jeandrain, Frank Biocca*

**12.30 Lunch****13.30 Session 13 : Measurement Methods**

**Chair: Frank Biocca**

**Experiences with Repertory Grid Analysis for Investigating Effectiveness of Virtual Environments**

*Anthony Steed, Janet McDonnell*

**The Thematic Baseline Technique as a Means of Improving the Sensitivity of Presence Self-report Scales**

*David Nunez, Edwin H. Blake*

**Affective Benefits in Communication: The Development and Field-testing of a New Questionnaire Measure**

*J.v. Baren, W. IJsselsteijn, N. Romero, P. Markopoulos, B. de Ruyter*

**Connecting the Presence's Factors for Guiding Measurements**

*Antonia Lucinelma Pessoa Albuquerque, Rubens Melo, Luiz Velho*

**14.30 Break**

**14.45 Session 14 : Emotions**

***Chair: Mel Slater***

**Investigating the Relationship Between Presence and Emotion using Virtual Mood Induction Procedures**

*Kristina Chapman, Jonathan Freeman, Edmund Keogh, Cath Dillon, Mercedes Jorquera, Beatriz Rey, Rosa Banos, Mariano Alcañiz Raya*

**The Gestalt of Virtual Environments**

*Jacquelyn Ford Morie, Josh Williams*

**Emotions and Presence: A dual link**

*G. Riva, J.A. Waterworth*

**15.45 Concluding Remarks by Programme Chair W.A. IJsselsteijn**

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*Ralph Schroeder*

**2. Is there a Trade-off Between Presence and Copresence?**

*Maria Spante, Ralph Schroeder, Ilona Heldal, Ann-Sofie Axelsson*

**3. Facilitating the Presence of Users and 3D Models by the Augmented Round Table**

*Erik Granum, Thomas B. Moeslund, Mortiz Störring, Wolfgang Broll, Michael Wittkaemper*

### Session 3 : Perception

**4. Preparing Virtual Streets for the Investigation of Mesopic Vision**

*Cecília Sik Lányi, János Schanda*

**5. The Importance of Shadows in Augmented Reality**

*C.B. Madsen, M.K.D. Sørensen, M. Vittrup*

**6. Rendering Quality and User Cognition: An Experimental Study**

*Katarina Mania, Dave Wooldridge, Andrew Robinson*

**7. Effects of Screen Size on Physical Presence, Self Presence, Mood, and Attitude toward Virtual Characters in Computer/Video Game Playing**

*Kwan M Lee, Wei Peng*

### Session 6 : OMNIPRES Symposium 1.1

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*Werner Wirth, Peter Vorderer, Tilo Hartmann, Christoph Klimmt, Holger Schramm, Saskia Böcking*

### Session 7 : Theory and Models

**9. Connectedness, Awareness and Social Presence**

*Ruth Rettie*

**10. Presence as Perceived Continuity of Experience**

*Richard Walker, Fabrizio Davide*

**11. The Strata of Presence: Evolution, Media, and Mental States**

*J.A. Waterworth, G. Riva, E.L. Waterworth*

**12. A Psychological Approach to Presence**

*C. Botella, R.M. Banos, M. Alcañiz*

**13. When Real Seems Mediated: Anti-Presence**

Lydia Reeves Timmins, Matthew Lombard

### **Session 8 : Agents**

**14. When Low Spatial Ability Does not get you “there” in 3D Environments, but Agent Jump out “Here” to Change Attitudes**

Frank Biocca, Linda A. Jackson, Lynette Lim, Weimin Mou, Gretchen Barbatsis, Alexander von Eye, Yong Zhao, Hiram Fitzgerald

**15. Effects of Interactivity and Expressiveness on Perceived Social Presence, Memory and Persuasion in Interactive Health Communications**

Hsuan-Yuan Huang

**16. Gender Identification with an Anthropomorphic Computer Help Agent: A Social Presence Approach**

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**17. Embodied Conversational Agents in E-Commerce. Do they sell?**

Gary Bente, Heike Blens, Nicole C. Krämer

### **Session 9 : Communication**

**18. Communication in Virtual Environments: Establishing Common Ground for a Collaborative Spatial Task**

Anne-Sofie Axelsson, Åsa Abelin, Ralph Schroeder

**19. On Transmitting Emotions – Experiments on Multimodal Presence over the Internet**

Gábor Tatai, László Laufer, Attila Szaló, Annamária Csordás

**20. Evaluation of the VIRTUE Video-Conference System Using the ITC-Sense of Presence Inventory**

Jonathan Freeman, Jane Lessiter, Oliver Schreer, Peter Kauff

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**21. Circular Vection is Facilitated by a Consistent Photorealistic Scene**

Jörg Schulte-Pelkum, Bernard E. Riecke, Markus von der Heyde, Heinrich H. Bühlhoff

**22. Using Eye Tracking and Psychophysiological Methods to Study Spatial Presence**

Jari Laarni, Niklas Ravaja, Timo Saari

**23. Cue Integration in the Haptic Perception of Virtual Shapes**

Knut Drewing, Marc O. Ernst

**24. “Dual” Embodied Interaction for Creating a Virtual Co-existing Space**

Shigeru Wesugi, Yoshiyuki Miwa

### **Session 12 : BIP & Applications**

**25. More Breaks Less Presence**

Andrea Brogni, Mel Slater, Anthony Steed

**26. Physiological Responses to Breaks in Presence: A Pilot Study**

Mel Slater, Andrea Brogni, Anthony Steed

**27. The Sense of Presence in a Sample of Patients with Neuropsychological Dysfunctions during a VR-enhanced Cognitive Rehabilitation**

*G. Castelnuovo, C. Lo Priore, Di. Liccione, A Gaggioli, G. Riva, Da. Liccione*

**28. Presence and High Fidelity Patient Simulators in Anaesthesiology: Influences Derived From Interviews and Questionnaires**

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**29. Should Product Involvement Facilitate the Experience of Telepresence? The Case of a Quasi 3-D Virtual Store**

*Anne-Cecile Jeandrain, Frank Biocca*

**Session 13 : Measurement Methods****30. Experiences with Repertory Grid Analysis for Investigating Effectiveness of Virtual Environments**

*Anthony Steed, Janet McDonnell*

**31. The Thematic Baseline Technique as a Means of Improving the Sensitivity of Presence Self-report Scales**

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**32. Affective Benefits in Communication: The Development and Field-testing of a New Questionnaire Measure**

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**33. Connecting the Presence's Factors for Guiding Measurements**

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**Session 14 : Emotions****34. Investigating the Relationship Between Presence and Emotion using Virtual Mood Induction Procedures**

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**35. The Gestalt of Virtual Environments**

*Jacquelyn Ford Morie, Josh Williams*

**36. Emotions and Presence: A dual link**

*G. Riva, J.A. Waterworth*

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**40. While Facilitating Presence for Marketing Purposes, Are you Persuading or Seducing your Consumers?**

*Anne-Cécile Jeandrain, Rita Lauria*

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**51. SoundScapes – A Concept and Methodology of „Being There“**

*A.L. Brooks*

**52. Sometimes I Really Hate Coming Back to this World: Presence and On-line Video Game Playing**

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“AM3D – True 3D Audio Algorithms”

*Sven Vetergaard, Preben Nielsen, Robert Stepien*

**54. BENOGO project – Being There Without Going**

*Erik Granum*

**55. G-Tec – Guger Technologies: Biosignal Acquisition & Processing**

“Physiological Recording Device for Presence Research”

*C. Guger, G. Edlinger, R. Leeb, G. Pfurtscheller, M. Slater*

**56. SaabTech – Head Mounted Display**

“AddVisor™ 150: A High-Resolution, Stereoscopic AR/VR head Mounted Display”

*Claes Bäckström*

## ***Accepted but not Presented***

**57. McLuhan, Heidegger and Presence Research**

*Tina Sikka, Marcelo Vieta*

**58. Erroneous Performance During Drowsiness as Switch of Presence Between Internal and External World**

*Vladimir B. Dorokhov*

## **(1) Beyond Presence and Copresence: A Phenomenological Account of Experiences in Shared Virtual Environments**

Ralph Schroeder

Chalmers University, Gothenburg, Sweden

Email: ralsch@mot.chalmers.se

### **Abstract**

The study of shared virtual environments (SVEs) has centered on presence and copresence and this has yielded important insights. One limitation, however, has been that presence and copresence vary with the context of use, or with the activity carried out in the VE. If we analyze activities in SVEs in a phenomenological or micro- social interactionist way, we see that there are several – but only a few *key* - factors that shape presence and copresence regardless of setting and activity. We also find that the experience in SVEs can be analyzed in terms of the 'focus of attention' of the user, and this simplifies the analysis because a) the focus of attention is limited, and b) this focus has a limited range of things it is devoted *to* in VEs.

To pursue such a phenomenological account, we can draw on the data from two sets of trial VE sessions and on the author's own experience (the author was a participant observer in both sets of sessions, but the discussion will also be based on data from interviews, video- and audio- recordings, and logs from the other participants). These two sessions, it will be claimed, are representative of a range of the most typical or common VE settings.

We can divide the experience into the following components: 1. place (where?) 2. task (doing what?) 3. interpersonal interaction and communication (how engaging with others?). This is perhaps the most general classification of the VE experience, but only the third applies specifically to *shared* VEs.

In relation to presence and copresence, this account raises several questions deserving of further research:

Under what conditions will a mismatch in focus of attention between the three components diminish presence and copresence? (and conversely, when is the user oblivious to such a mismatch?)

Under what conditions will the disruption to the flow of the focus of attention by forces outside the VE will diminish presence or copresence?

More generally, how can the flow of the focus on the three components be structured over the course of the experience so as to maximize and maintain presence and copresence?

By identifying the most common forces shaping experiences in SVEs and presence and copresence, it will be possible to put forward some hypotheses for further research and for how to design systems.

## (2) Is there a trade-off between Presence and Copresence?

Maria Spante, Ralph Schroeder, Ilona Heldal, Ann-Sofie Axelsson

Chalmers University of Technology

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### Abstract

Presence and copresence have been key goals of researchers and developers of shared virtual environments (SVEs). Much research has assumed that the two reinforce each other; that is, an enhanced sense of presence enhances copresence and vice versa. We need only to think of equivalent face-to-face situations, where we are highly aware of the other person but not of the surroundings – and the other way around – to recognize that this may not necessarily be the case.

In this essay we question the assumption that the two go together in SVEs, and provide some examples where high presence and low copresence are observed - and the opposite. Here we report qualitative data from various studies in SVEs, immersive as well as desktop. We exemplify situations where it can be seen that high co-presence can coexist with low presence and vice versa. The findings reported to date concerning presence and copresence are about the psychological state of the user - either for their experience at a particular point in time, or how they report their state for the session as a whole. This may not, however, adequately reflect the way in which the experience can vary over the course of the session, and therefore how the relationship between presence and copresence can vary.

This paper suggests that there may be conflicts or trade-offs between presence and copresence in certain situations in SVEs, and this may apply not only to the segments of tasks or of communication situations as in our examples, but to longer periods during a session. Our examples show that presence and copresence do not necessarily go together. Thus there is a need for more systematic research regarding the relationship between the two concepts in SVEs.

### (3) Facilitating the Presence of Users and 3D Models by the Augmented Round Table

Erik Granum, Thomas B. Moeslund and Moritz Störring,  
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Email: {eg,tbm,mst}@cvmt.dk

and

Wolfgang Broll and Michael Wittkaemper  
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#### Abstract

Round table meetings are regularly used between professionals to review development, to design new approaches and to make decisions. While these roundtable meetings naturally facilitate the collective presence of users they often lack a sophisticated presence of the actual object discussed.

In this paper we present the Augmented Round Table for architectural design. We use Virtual Reality technologies to augment the users' common workspace by virtual 3D objects and providing real world interfaces to them – thus making them present. In praxis the augmentation is done via a see-through head mounted display and the interfacing is done by having computer vision systems to recognise and track real world items and hand gestures preformed by the users.



In the paper it is suggested that it is possible to have simultaneous presence in different worlds. A way in which we propose this is when the presence in the one world can be functionally embedded in the other. In the situation of round table meetings, discussed in this paper, the social and collective aspects are important, and one may wonder if this is a necessary condition or just facilitating the simultaneous presence.

#### **(4) Preparing virtual streets for the investigation of mesopic vision**

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##### **Abstract**

We investigate at the Colour and Multimedia Laboratory of the University of Veszprém the human vision under mesopic conditions.

If the luminance of the environment is above of a few  $\text{cd/m}^2$  (daylight situation) our visual system is photopically adapted. Under such conditions we see details clearly and can also observe colours well. In darkness (night situation without clear moonlight) the luminance of the environment is below  $10^{-3} \text{ cd/m}^2$ . In such situations our ability to see details is poor and we can not distinguish colours. Between the two extreme lighting situations, i.e. roughly between  $3 \text{ cd/m}^2$  and  $10^{-3} \text{ cd/m}^2$  we loose gradually our colour vision and the visual acuity becomes poorer and poorer. This region is called mesopic vision. The metrology of visual stimuli under mesopic conditions is called mesopic photometry. There are several models describing brightness corresponding photometric attributes for mesopic photometry, but there is no good model for detail perception and of the wavelength sensitivity of the human eye under such mesopic conditions. Mesopic vision is, however, very important in nightly traffic situations, practically all street lighting produces mesopic vision. The investigation of visibility under such conditions is very important to achieve safer traffic situations.

The investigation of traffic situations (accident avoiding, etc.) is difficult in real environment. Virtual reality is a good candidate to investigate human reactions in dangerous circumstances. Therefore we have prepared animations of situations that might occur under mesopic driving conditions and have investigated how different test persons react e.g. on the observation of an obstacle appearing in front of the vehicle.

The animations have been produced by the help of a three-dimensional animation software, Maya 4.5 that enabled us to produce animations of high reality content where also the night-time appearance of the street with street-lightning could be produced.

Key-words: virtual reality, mesopic vision, animations

## (5) The Importance of Shadows in Augmented Reality

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### Abstract

Visual perception in the real, physical world relies heavily on cast shadows for interpretation of the spatial relationships between objects. I.e., shadows cast by objects onto other objects/surfaces is an important perception cue for understanding the 3D structure of the world, alongside with stereo disparities, size relationships, texture, and shading. In fact, recent experiments have shown that information from shadows can overrule information from stereo disparities and size relationships.

In Augmented Reality (AR) virtual objects are visually integrated with the real world to create the illusion of the virtual objects being a part of the real scene. But in light of the above statements concerning the importance of shadows it is clear that believability of, and the user's ability to spatially interpret, an AR scenario depends on functionality for enabling the augmented virtual objects to cast shadows on surfaces in the real world. Similarly, the virtual objects should have shadows cast on them from real world objects. And the virtual shadows should be consistent with the real shadows, for example in terms of lighting direction causing the cast shadows.

In order to be able to augment a real scene with both objects and shadows it is necessary to have a model of the lighting conditions in the real scene, and this model must be suitable for real-time computer graphics rendering. The work presented in this paper addresses this problem.

Our work is based on imaging the entire real scene from a central location, resulting in an omni-directional image, i.e. a panoramic image covering the full 360 by 180 degree field-of-view of the scene. This panoramic image is then used as a basis for estimating the directions and radiant power (color and intensity) of some limited number of light sources. These estimated light sources are then used in the real-time computer graphics rendering of virtual objects, such that virtual object shading and cast shadows are consistent with the lighting conditions in the real scene.

We have tested our technique with good results on various scenarios: a glass green house in a botanical garden with lighting conditions dominated by the sun and the greenish reflections from plants; an indoor hall with lighting dominated by three large windows; and a laboratory scene with multiple overhead light fixtures.

## (6) Rendering Quality and User Cognition: An Experimental Study

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### Abstract

The effect of rendering quality on spatial cognition is investigated. A between groups experiment was carried out to explore the effect of rendering quality (flat-shaded vs photorealistic radiosity rendering) on object-based memory recall and memory awareness states. The general premise of this research focuses on 'how' tasks are achieved, rather than only on 'what' is achieved. Interestingly, results revealed a higher proportion of visually induced recollections associated with the flat-shaded condition. This finding follows similar findings in two previous studies that demonstrated that the less 'naturalistic' interaction interface also provoked a higher proportion of visually induced recollections (Mania et al. 2003).

### Experiments and Results

The experimental space, consisting of two interconnected rooms that included primitive objects (boxes, sphere, pyramids), was rendered either flat-shaded or using radiosity rendering. The computer graphics simulations were displayed on a stereo Head Mounted Display with head tracking. 16 participants across two conditions of varied rendering quality completed a memory task after exposure to the experimental space. Participants described how they completed spatial recollections by selecting one of four choices of awareness states after retrieval. These reflected the level of visual mental imagery involved during retrieval, the familiarity of the recollection and also included guesses, even if informed (Tulving, 1985). Experimental results revealed variations in the distribution of participants' awareness states across conditions while, task performance failed to reveal any. In particular, there was a higher amount of correct visually induced recollections associated to the flat-shaded condition compared to the photorealistic radiosity condition. By decreasing the degree of 'realism' of the rendering (visual fidelity), participants -paradoxically- adopted visually induced recollections. Achieving high fidelity could incorporate the need for similar awareness states between a real-world task situation and its computer graphics simulation. Something less 'real', therefore, less computationally expensive but more demanding because of its novelty or variation from 'real' may restore a more 'naturalistic' awareness state. There was no effect of viewing condition upon the presence dataset as measured by the SUS questionnaire (Slater et al., 1998). How the degree of 'reality' of the motor response or rendering quality relates to presence assessments (if at all) remains an open research question.

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Slater, M., Steed, A., McCarthy, J., Maringelli, F. (1998). The Influence of Body Movement on Subjective Presence in Virtual Environments. *Human Factors: Journal of the Human Factors Society*, 40(3), 469-477.

## **(7) Effects of Screen Size on Physical Presence, Self Presence, Mood, and Attitude toward Virtual Characters in Computer/Video Game Playing**

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### **Abstract**

The current study investigates the effects of screen size on feelings of presence (physical and self), mood, and social responses to avatars on the screen, in the context of computer game playing. Thirty participants played a third-person point of view (POV) computer game--Tomb Raider II--with either a small screen (14 inch standard monitor) or a large screen (81 inch ImmersaDesk). Participants who played the game with a large screen reported significantly higher feelings of presence (both physical and self presence). Furthermore, they exhibited more intense changes in their mood after playing the game, especially Positive Affect measured by MAACL-R (Multiple Affect Adjective Check List-Revised). Participants with a large screen also evaluated the avatar--Lora Craft--of the game as being more sociable. In addition, the analyses of the pre-experiment survey data reveal that game users' feelings of presence are positively correlated with their computer game self efficacy and negatively correlated with their age. Theoretical implications of the current study to the study of presence and social interaction with avatars are discussed.

## **(8) Constructing Presence: Towards a two-level model of the formation of Spatial Presence experiences**

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### **Abstract**

Contemporary Presence research is in demand of a commonly accepted theoretical framework for theorizing and empirical studies. Therefore, we introduce a conceptual model of Spatial Presence (Vorderer, Wirth, Saari, Gouveia, Biocca, Jäncke, Böcking, Hartmann, Klimmt, Schramm, Laarni, Ravaja, Gouveia, Ribeiro, Sacau, Baumgartner, & Jäncke, 2003). The model regards Spatial Presence as state that is affected both by internal and external (media) factors. It is organized in two levels of processes that are involved in the emergence of Presence:

The first level refers to the formation of a spatial situation model (SSM). It is a mental model of the perceived spatial (media) environment. The formation of the SSM depends on the spatial cues provided by the media product as well as the users' spatial knowledge structures, motivational state and their resulting attentional focus.

On the model's second level, the transition from the mere existence of an SSM towards the actual state of Presence is facilitated through the (successful) test of a perceptual hypothesis. The hypothesis states that the mediated environment is the "primary ego-reference frame". If it is confirmed, users assign their self-location and perceived possible actions to the mediated environment (i. e., they feel Presence). Various media attributes and user characteristics influence this transition to the state of Presence.

Vorderer, P., Wirth, W., Saari, T., Gouveia, F. R., Biocca, F., Jäncke, F., Böcking, S., Hartmann, T., Klimmt, C., Schramm, H., Laarni, J., Ravaja, N., Gouveia, L. B., Ribeiro, N., Sacau, A., Baumgartner, T. & Jäncke, P. (2003). *Constructing Presence: Towards a two-level model of the formation of Spatial Presence*. Unpublished report to the European Community, Project Presence: MEC (IST-2001-37661). Hannover, Munich, Helsinki, Porto, Zurich.

## **(9) Connectedness, Awareness and Social Presence.**

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### **Abstract**

#### **Introduction**

This paper discusses the concept of 'connectedness', exploring its relationship to the concepts of 'social presence' and 'awareness', and arguing that although 'social presence' and 'awareness' have received most focus in previous research, 'connectedness' is in fact a more fundamental concept. 'Connectedness' is potentially a key concept in the analysis of communication and the development of interactive devices.

#### **Discussion**

The concept of 'connectedness' is related to the concept of 'social presence', but it is not equivalent. Social presence is a judgement of the perception of the other participant and/or of the medium, whereas connectedness is an emotional experience, evoked by, but independent of, the other's presence. Connectedness relates to the sense of social presence classified by Biocca et al. (2001), as psychological involvement. In awareness systems there may be virtually no social presence, i.e. little salience of the other person, and no access to their intelligence, intentions or sensory impressions, however, at the same time there may be a feeling of psychological engagement and experience of connectedness. Awareness here is not used in the sense of having heard of as in, 'I am aware of President Bush', nor in the sense of thinking about someone, but in the sense of experiencing what is believed to be an external perception, whether synchronous or asynchronous.

The paper analyses the logical relationships between the three concepts. Connectedness usually coincides with awareness, because the awareness triggers the experience of connectedness. The paper discusses whether connectedness can occur without awareness or whether connectedness implies awareness of the other person. It is suggested that connectedness may be stimulated by the awareness of objects, although the meaning embodied in the experience is derived from the other person. In this case, connectedness occurs without awareness of the other person; for example, a stored text message in a mobile phone evokes the experience of connectedness without awareness of the presence of that person.

## (10) Presence as perceived continuity of experience

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### Abstract

This paper identifies difficulties in current definitions of "presence", proposing an alternative definition, based on recent work in "consciousness studies". In the model recently proposed by F. Biocca, the user of a virtual environment is located in a space defined by three "poles of attraction": mental imagery, the virtual environment and the physical environment. However, introspection suggests that this representation is inaccurate. We can feel present in a virtual reality *or* in a physical environment but *never in both environments at once*: in terms of Biocca's model, users are always located at one of the poles and never in intermediate positions.

Insights from consciousness studies allow us to build on this intuition. Edelman and Tonoli suggest that consciousness presents us with a single, non-contradictory interpretation of the world: we can interpret an environment as if it were real or as if it were artificial but we cannot hold both interpretations at the same time. Combining this concept with ideas from Damasio, we propose that presence can be defined as a *subjective feeling, representing the emotions associated with a perception of continuity in the brain's interpretation of the world*. The opposite of a sense of presence is the *feeling of non-continuity* when our brains flip between different interpretations: what M Slater has called a "break in presence" (BIP). Presence is experience without BIPs.

It is often suggested that presence depends on the realism of virtual environments. The concept of presence as perceived continuity of experience suggests, on the contrary, that the true cause of presence is a medium's ability to monopolize the user's attention – as achieved by the best books, films, theater and videogames. If this is true the future effectiveness of virtual media will depend on new forms of artistic expression: not just *quantitative improvements* in technology but *qualitative changes* in the way the technology is used. We are learning how to print – now we need to write.

## (11) The Strata of Presence: Evolution, Media, and Mental States

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### Abstract

We present an evolutionary account of the psycho-neurology of presence, highlighting three component layers: proto presence, core presence, and extended presence. We suggest that the layers emerged through evolution, but all contribute to common survival goals: distinguishing what currently lies outside the organism from that which is within, and ensuring that attention is directed towards significant external events. *Proto presence* is our term for the most primitive layer, which corresponds to the earliest development of a sense of self versus other. It can be identified with the proto consciousness of sensation and of proprioception, of the body's orientation and of what is happening at the body boundary. *Core presence* can be identified with perception of an external world surrounding the body, of things in space in the proximity of the body in the here and now. *Extended presence* relies on memory and imagination and relates what is happening in the present to stored knowledge from past experiences, but which may also be about possible futures.

Different media address different layers, and the technological trend is to address all layers to some extent – as in immersive virtual environments. We suggest that the degree of experienced presence depends on how well the three layers are integrated, how *focused* they are on the same information (Riva and Waterworth, 2003). The three layer model of presence allows us to explain and predict the effect of different types of media on the level of presence. We interpret this in terms of varying psychological states that may arise in relation to media: *absence*, *presence*, and *hyperpresence*.

Immersive environments are unique amongst media in their ability to produce a sense of presence as high as the maximal levels experienced in the physical world. But, as in the physical world, immersion does not guarantee presence. If what is happening is not of interest or importance to the individual, the layers of presence will not be integrated (or *focused*) and the person will tend to become absent (in life, the absent-minded professor is the archetypical example). Immersion, if appropriately implemented, gives a potential for exceptional presence not provided by media that only address one or two layers. But one can be more or less present in any environment. Content is the key.

## (12) A Psychological Approach to Presence

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### Abstract

Biocca (2003) pointed out that research on presence has been carried out from the perspective of a two poles psychological model: the user is present in the physical space or in the virtual world. From this perspective, it has been stated that the central aspects in presence were technological, and technology was given priority. But currently there exists an extensive accord about considering presence as a psychological phenomenon (Schubert, Friedman and Regenbrecht, 2001). From a psychological perspective, this accord is an advance, but the current theoretical models keep contemplating the sense of presence as a direct function of the immersion capacity of the system. Most of the current definitional proposals about presence are mainly focused on one part of the binomial considered by Slater (2003), and they give a central role to the *medium*. In the same way, even recognising the role of the human processing, the proposal by Lombard and Ditton (1997) talks about "the perceptual illusion of non mediation", so it is also centred on the medium, by speaking about non mediation. Finally, Steuer (1992) defended the convenience of speaking of a human experience. However, he has been also focused on the analysis of the factors of the *system* (vividness and interactivity) that have an influence on that human experience. Nevertheless, it can be a mistake to assume a lineal relation between presence and immersion. As Schubert et al. (2001) point out, several cognitive processes *mediate* the effect of immersion in producing presence in the user.

Our intention is not to forget the other part of the binomial, that is, immersion (in Slater's terminology). We think that technology is important, but are the technological aspects sufficient to achieve the sense of presence? We do not think so. In this work we defend the convenience of considering psychological aspects in the field of VR and, specifically, in the ambit of presence. We defend the following thesis: 1) The need of a psychological theory of presence in the field of VR; 2) the need of taking into account other psychological aspects in addition to presence. At least for some applications it is necessary to consider concepts such as consciousness, reality judgement, memory, attention, emotions, personality dimensions, etc. In this work, we analyse briefly the importance of the consciousness and reality judgement.

### **(13) When Real Seems Mediated: Anti-Presence**

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#### **Abstract**

As media scholars and pundits frequently note, our lives are increasingly dominated by mediated experiences - traditional media including the telephone, radio, television, film, newspapers and magazines have been joined by e-mail, instant messaging, chat rooms, cell phones, video games, HDTV, the web, simulator amusement rides and soon virtual reality. As presence scholars have noted, an increasing number of these mediated experiences evoke (tele)presence, perceptions that ignore or misconstrue the role of the medium in the experience.

But an interesting counter-trend seems to be occurring as well. In a variety of contexts, people are experiencing not an illusion that a mediated experience is in fact nonmediated, but the illusion that a nonmediated, "real" experience is mediated. Drawing on examples from newspapers, television and radio stories, we identify three categories of this "illusion of mediation": positive (when people experience natural beauty and equate it with a mediated experience), negative (when people experience a disaster, crime or other tragedy, such as the events of September 11, 2001, and equate it with a mediated experience), and unusual (when close connections between people's "real life" activities and mediated experiences lead them to confuse the two).

We label this phenomenon anti-presence and consider its place and value in a comprehensive theory of presence, its possible antecedents and consequences, and what it suggests about the nature of our lives in the 21st century.

**(14) When low spatial ability does not get you “there”  
in 3D virtual environments,  
but agents jump out “here” to change your attitudes.**

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**Abstract**

An experiment explored the relationship between interface interaction style and individual differences in spatial ability and involvement on levels of presence. The study also explored the relationship between levels of presence and changes in attitudes and learning. All interfaces delivered the same public health information about high blood pressure. The health information pages were presented via one of three different interface styles: (1) magazine-style traditional interface, which served as a control, (2) an interpersonal interface using a conversational agent, and (3) a 3D virtual environment.

The interpersonal agent interface produced more (engagement) presence than did a 3D spatial and magazine-style (control) interface. It was also seen as more realistic. This suggests that interaction with simple intelligent entities may be more engaging than interaction with uninhabited 3D environments or textual environments.

A surprising result was that the 2D conversational agent interface produced significantly higher levels of spatial presence than did the interface with a 3D virtual environment. The results also suggest that users with low spatial ability may have found 3D spatial interfaces to be cognitively demanding.

Consistent with findings from the e-commerce and health communication studies, presence is related to attitudes towards the environment (site) and attitudes towards the sponsor-creator of the site. Consistent with a model that presence is influenced by shifts in attention and spatial updating; the relationship was stronger for the more attention related dimensions of presence (engagement), than for spatial presence, which was not correlated with attitudes.

There were no significant relationships between presence and learning of non-spatial information about blood pressure. Not surprisingly, a report of negative experiences with the interfaces was correlated with decreased learning.

## **(15) Effects of Interactivity and Expressiveness on Perceived Social Presence, Memory and Persuasion in Interactive Health Communications**

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### **Abstract**

This experiment primarily focused on how media variables such as interactivity and agent emotional expressiveness affected user's perception of social presence of the computer agent. Secondly, we were interested in exploring how interactivity and expressiveness affected the user's memory, attitude, and behavioral intention to a health communication message.

#### **Effects of interactivity and expressiveness on social presence and persuasion**

This study employed animated intelligent characters to guide young adult users ( $N = 124$ ) in a drunk-driving prevention program. This 2x 2 between subject experiment resulted in no interaction effect between variables. Overall, users who encountered an emotionally expressive agent perceived higher levels of social presence of the agent. Out of the nine factors composing social presence, users felt higher levels of mutual awareness, understanding, and more empathy and felt a strong sense of expressive animated agent's behavioral dependency on them. Meanwhile, interactive media users felt higher levels of mutual awareness between themselves, the agent and others respectively. They also felt higher levels of mutual understanding and animated character's behavioral dependency on them. Surprisingly, participants lacking two-way interaction with the animated character also felt high level of empathy. This phenomenon mirrors para-social relationships in traditional media, as when television audiences react to TV personae.

Interactive media fared better in facilitating learning health materials, while expressiveness did not figure significantly in learning. For attitude change, as the pre and post attitude score did not differ significantly, it is possible that there was a "ceiling effect" given that the pre-attitude scores strong. As attitude and behavioral intention may be highly linked when the subject is of high involvement, it is not surprising that neither variable had significant impact on behavioral intention.

## **(16) Gender Identification with an Anthropomorphic Computer Help Agent: A Social Presence Approach**

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### **Abstract**

When designing websites or other information environments, designers strive to match user preferences with the design features of a computer interface. Much of the tailoring of the structural features of content in online environments is based on matching user preferences with the structural and content features of the information. The implicit assumption is that a match between user and the computer source on key social variables can lead to positive outcomes. In fact, these tailoring techniques have been found to be quite effective in various domains, including health and consumer behavior.

As the concept of tailoring continues to grow, one of the approaches could be the use of tailored anthropomorphic computer agents that simulate social identification. Researchers studying human-computer interaction have examined the opportunities and challenges associated with the use of anthropomorphic computer agents. After reviewing the literature on animated interface agents, Dehn and Mulken (2000) suggest that the results are mixed in terms of knowing whether anthropomorphic agents are useful or not. In summarizing the state of the art of the findings they state that the usefulness of anthropomorphic interfaces depends on the attributes of the agent, task context, individual differences among users, and most important, the criterion variables used to judge the usefulness of the agent. Given the ambiguities in the current findings, in this study we focused on only one key attribute, namely the gender of the agent, and examined the effects of a match or mismatch between the gender of the respondent and the gender of an anthropomorphic computer agent.

Using items from a social presence measure (Biocca, Harms, & Burgoon, 2002) we tested the effects of the gender of the help agent on overall usefulness, on perceived warmth/friendliness of the agent, co-presence, attention and understanding. Agent's gender did not seem to have an effect on males. However, female respondents showed strong in-group support, by rating the female agent significantly higher than the male agent on various dimensions such as co-presence, attention, and understanding, but not on overall task performance. Female respondents also rated the female agent higher than an interface without agent cues. The implications of the results for agent design are examined.

## **(17) Embodied Conversational Agents in E-Commerce. Do they sell?**

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### **Abstract**

Embodied Conversational Agents (ECAs) are considered to improve human computer-interaction in many ways, making the interaction more intuitive, fostering the acceptance of complex systems and increasing user motivation and task performance. Beyond the scope of scientific research ECAs already show an increasing presence in the internet, taking the role of virtual assistants in guided tours or virtual sales people presenting the offerings of an e-commerce shop to the user. Although these applications might benefit from the appearance of an ECA in a more general way leading to better acceptance and liking the most important question to be answered empirically is still pending: Do ECAs really sell? Do they lead to better page impressions and do they increase the users' readiness to buy a product on the respective site? To test the effects of ECAs within e-commerce applications three online-bookstores (two with ECAs and one text-based). Figure 1 shows the home page of one of the experimental bookstores. To account for possible variance induced by the appearance of the ECAs two different characters were used: a more realistic anthropomorphic character and a comic-like character. Product categories as well as the particular books were matched for the sites. Verbal dialog was conducted in text mode using bubbles for the verbal responses of the ECAs.

45 participants took part in the experiment. Major attention was paid to cognitive and behavioural output measures. Memory effects were tested in an aided and unaided recall procedure. General interest was quantified by means of an objective measure, i.e. the time spent on each site. In contrast to many other studies buying behaviour was not measured by questionnaire but by direct observation: participants had to spend their incentive by buying a book in one of our internet bookstores and could decide in which one. In addition, subjective measures were taken using an adjective check list to indicate interest and mood of the participants. As expected the ECA sites produced a highly significant entertainment effect. Subjects felt more amused on the ECA sites and less bored. Also the results of the unaided recall reveal a significant difference between the ECA sites and the text interface site. ANOVA further revealed a highly significant effect of the ECAs with respect to the time participants spent on each site. Both ECA sites induced longer stays on the sites, whereas both ECA sites did not differ significantly. Finally, we found a significant positive influence of the ECAs on users' actual buying behaviour.

## **(18) Communication in Virtual Environments:**

### **Establishing Common Ground for a Collaborative Spatial Task**

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#### **Abstract**

The aim of this study was to find out how the communication process in a shared virtual environment (SVE) varies depending on which type of technical system is used. Of specific interest in the study was how common ground, a fundamental part of the communication act, is established in various computer-mediated collaborative situations.

Participants in this study carried out a collaborative task solving a Rubiks-cube type puzzle in three different conditions: (1) in a SVE where one person used an immersive projection technology (IPT) system and the other person used an ordinary desktop system, (2) in a SVE where both persons used the same type of IPT system (though they were in different countries), and (3) in a SVE where both persons used ordinary desktop systems.

By varying the technologies in the SVE conditions we wanted to investigate how the grounding process is affected by the different technologies used as well as by the combination of same and different VR systems.

By analyzing audio recordings of the communication between the partners in the three conditions we found that the grounding techniques vary between the different conditions due to the characteristics of the technologies used. Most important to the grounding process we found were the technical possibilities of: (1) hearing the partner, (2) seeing the partner and partner's objects, (3) sharing the view of the environment with the partner, and (4) understanding how (with what devices) the partner interacts with the SVE.

In this paper we discuss how different VR technologies affect the grounding process. We also make suggestions of how to facilitate networked collaboration in the future.

## (19) On Transmitting Emotions

### - Experiments on Multimodal Presence over the Internet

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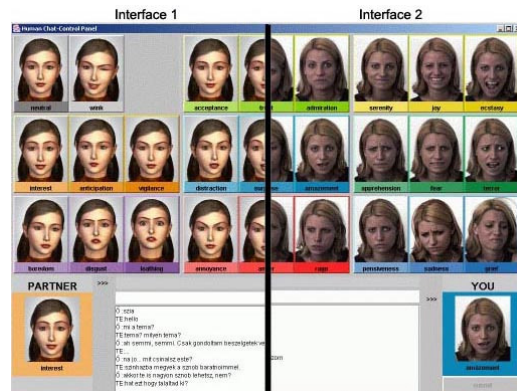
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### Abstract

In this paper we are presenting a multimodal chat interface displaying and transmitting emotions between chat partners, developed for an Internet chatterbot system. The system includes a 3D emotional chat interface that uses a complex emotional model based on R. Plutchik theory on basic emotions, published in detail and evaluated in our earlier publications. Based on this model, we have created and used one animation for each of the 24 emotions and the additional neutral state.

We conducted experiments to evaluate the effectiveness of various emotional animations (virtual 3D face animations and real human face clips, see Interface 1 and Interface 2, respectively, on the figure). We intended to determine the most natural layout and advantages of these interfaces. Both users could select an appropriate emotion when sending their message, and could simultaneously see their own and their partner's virtual face (see pictures in the bottom corners of the figure). The results of the experiments will be utilized to enhance our chatterbot's performance.



75 students filled out questionnaires after participating in the 3 experimental scenarios: traditional chat, chat using Interface 1, and then Interface 2. As we previously expected, both interfaces were more popular than the traditional chat. Users applied twice as many emotion icons as they remembered. The average was 8.95 ( $s=3.13$ ) and participants remembered only 4.62 used emotions by average. We concluded from our further experiments that chatters remembered only those emotions that had stronger emotional impact or were used frequently. When asked to estimate the number of used emotions, chatters did not think back to how they were using the interface, but rather recalled the feeling about the conversation, and of the emotional states they went through. In this sense we captured the emotional aspect of the presence phenomena since users "got lost" in the virtual world during the chat and they used the interface intuitively.

## **(20) Evaluation of the VIRTUE Video-Conference System Using the ITC-Sense of Presence Inventory**

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### **Abstract**

Whilst the experiential benefits of early video conferencing (v-c) systems were largely outweighed by commercial and usability barriers, recent technological developments such as improved video compression techniques, higher telecommunications bandwidth and a better understanding of designing for presence, have enabled the development of compelling v-c systems that are enjoyable and satisfying to use.

On the basis of research into the determinants of presence, partners in the EC funded IST project VIRTUE designed a video conferencing system with the key goal of providing a more satisfying user experience – enabling users who are remotely located to feel a sense of presence in the shared communication space and with each other (co-presence). In the study reported here, the system was evaluated using the ITC-Sense of Presence Inventory (ITC-SOPI: Lessiter, Freeman et al., 2001). The ITC-SOPI is a post-experience, self-completion presence questionnaire that measures 3 dimensions of presence (a sense of: physical space, engagement, and naturalness), and also provides a measure of the negative effects caused by a media system.

The VIRTUE system was rated highly on each of the 3 ITC-SOPI presence scales, and received low ratings on Negative Effects. For the Sense of Physical Space dimension, ratings were higher than any media the ITC-SOPI was piloted on except for 3D IMAX. For Naturalness, ratings were higher than any media system the measure was piloted on. For Engagement, reasonable ratings were obtained, though these are less relevant to the VIRTUE evaluation as the ITC-SOPI Engagement scale is most sensitive to variations in media content.

The results of the VIRTUE evaluation raise questions that the authors will discuss in the presentation of this paper. For example, though it was developed to evaluate spatial presence, is the ITC-SOPI a useful measure of social presence? In addition, what is the relationship between dimensions of physical presence and social presence – for example, did the fact that natural interaction was supported between remotely located participants result in the high Naturalness ratings the system received? Whilst further research is likely to be needed to answer these questions, the positive evaluation of the VIRTUE system using the ITC-SOPI is encouraging for the system's developers.

## **(21) Circular vection is facilitated by a consistent photorealistic scene**

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### **Abstract**

It is well known that large visual stimuli that move in a uniform manner can induce illusory sensations of self-motion in stationary observers. This perceptual phenomenon is commonly referred to as vection. The prevailing notion of vection is that the illusion arises from bottom-up perceptual processes and that it mainly depends on physical parameters of the visual stimulus (e.g., contrast, spatial frequency etc.). In our study, we investigated whether vection can also be influenced by top-down processes: We tested whether a photorealistic image of a real scene that contains consistent spatial information about pictorial depth and scene layout (e.g., linear perspective, relative size, texture gradients etc.) can induce vection more easily than a comparable stimulus with the same image statistics where information about relative depth and scene layout has been removed. This was done by randomly shuffling image parts in a mosaic-like manner. The underlying idea is that the consistent photorealistic scene might facilitate vection by providing the observers with a convincing mental reference frame for the simulated environment so that they can feel "spatially present" in that scene. That is, the better observers accept this virtual scene instead of their physical surrounding - i.e., the simulation setup - as the primary reference frame, the less conflict between the two competing reference frames should arise and therefore spatial presence and ego-motion perception in the virtual scene should be enhanced. In a psychophysical experiment with 18 observers, we measured vection onset times and convincingness ratings of sensed ego-rotations for both visual stimuli. Our results confirm the hypothesis that cognitive top-down processes can influence vection: On average, we found 50% shorter vection onset times and 30% higher convincingness ratings of vection for the consistent scene. This finding suggests that spatial presence and ego-motion perception are closely related to one another. The results are relevant both for the theory of ego-motion perception and for ego-motion simulation applications in Virtual Reality.

For more information see [www.poems-project.info](http://www.poems-project.info)

Acknowledgements: This research was supported by the EU grant POEMS-IST-2001-39223 and by the Max Planck Society.

## **(22) Using eye tracking and psychophysiological methods to study spatial presence**

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### **Abstract**

This paper explores the benefits and promises of eye tracking and psychophysiological methods in measuring presence and relates them briefly to new types of applications in which the detection of presence is essential to the task of the user. Our starting point is the assumption that the degree to which people attend to a continuous stimulus flow is related to their state of presence.

There are several different ways to use eye tracking methodology to investigate spatial presence. The simplest way is to measure with eye tracking the degree to which the user's attention is distracted away from the media stimuli. Another possibility is to analyze which aspects of the mediated information the user looks at and the order in which different areas of media stimuli are processed. For instance, if the user feels present in the mediated environment, her attention is presumably directed most of the time to the relevant information. The third possibility is to classify attentional states to focused attention and distributed attention on the basis of eye fixation duration. It can be assumed that when the user is engaged in the mediated world she uses the distributed attentional strategy more often.

When the eye movement data is synchronized with the cardiac data, one can perform a fine-grained analysis of the relationship between the visual elements of the mediated stimulus and physiological responses. While eye movements provide a measure of the direction of attention, cardiac data (phasic heart rate deceleration, respiratory sinus arrhythmia) provide quantitative measures of automatic and controlled attention.

The methodology of studying presence presented in this paper has various benefits and promises for future research directions. First, presence may be measured as a continuous phenomenon. Second, more objective measures may be applied compared to self-report ratings of felt presence. Third, if it is possible to reliably and objectively detect the state of presence of a particular user of information technology, this information may be used in constructing new types of adaptive systems and human computer interfaces.

## (23) Cue Integration in the haptic perception of virtual shapes

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The sense of presence in virtual environments may be greatly improved by the display of haptic virtual reality. Current haptic display technology, however, mostly remains unsatisfying and expensive. One way to overcome existing technical limitations might be to "cheat" the haptic system by exploiting its principles. Importantly, human perception of an environmental property normally relies upon the integration of several different cues, which technologically may - at least partly - be substituted to one another. A recent promising starting point for such substitution is the experimental demonstration that haptic perception of three-dimensional shapes can be evoked by just two-dimensional forces (Robles-de-la-Torre & Hayward, 2001: Nature). The experiment dissociated positional and force cues in the perception of small-scale bumps: When sliding a finger across a bump on a surface, the finger follows the geometry of the bump providing positional cues for the shape. At the same time the finger is opposed by forces related to the steepness of the bump. Participants in this experiment reported to feel the shape indicated by the force cues and not by the positional cues.

The present study extended this research. We aimed to disentangle the contributions of force and position cues to haptic shape perception more systematically and to explore their integration principles. For that purpose, we constructed a set of virtual standard curves, where we intermixed force and position cues related to curvatures of 0, 8 and 16 /m using the PHANTOM haptic device. Participants compared these to curves in which both cues were correlated (i.e., "natural" curves) following the method of constant stimuli. We fitted psychometric functions to the data set from each participant and each standard curve, thus, obtaining PSEs (points of subjective equality) and 84%-discrimination thresholds. Most importantly, both force and position cues of the standard curves systematically contributed to the perceived curvature indicated by the PSEs. Moreover, for each participant perceived curvature could be well described as a weighted average of the curvature as conveyed by the force and by the position cue. The appropriateness of this simple linear model fits with previous findings from visual and visuo-haptic cue integration (see, e.g. Ernst & Banks, 2002: Nature). Note, that in our experiment, force cues on objects that according to position cues were planes evoked the impression of curves. Moreover, for haptic display these results imply that - at least partly - one cue may be substituted for the other in a predictable manner.

**(24)“Dual” embodied interaction for creating a virtual co-existing space**

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**Abstract**

A significance of engagement in face-to-face has been pointed out in computer mediated communication area. In order to create such a co-existing situation, mainly two approaches can be available; visual interaction and tangible interaction. However, each approach is insufficient to create a virtual co-existing space. Therefore we devise a complementary approach to integrate visual interaction and tangible interaction. This is not an approach just to combine two interactions. Our unique point is that a physical object, which we can interact with, is concurrently represented as a virtual physical object in a shared virtual space where we can interact by virtual avatar. Based on this concept, we implemented networked "Lazy Susan" communication system. We can rotate the disk with each other, the rotation of which is synchronized with remote disk, then the disk is represented as a virtual physical disk in a shared virtual space where we can interact with a remote participant by virtual avatar of our own and the remote participant. Then the preliminary results of communication experiments indicate that our "dual" interaction design is significant to enhance a sense of "being co-located".

In order to create a co-existing space in a physical place as well as in a shared virtual space based on this "dual" embodied interaction design, we integrated a video projection system into the networked "Lazy Susan". The video projection "Lazy Susan" can synthesize local and remote tabletop images, and can project the synthesized image onto a screen over the table at each site. This system is promising to enhance a co-existing space by means that a participant can view a common video image of self and a remote participant at each local physical place, and that their bodily interaction can be supported through a virtual coupled disk.



Figure: Video projection "Lazy Susan"

## **(25) More Breaks Less Presence**

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### **Abstract**

#### **Introduction**

The concept of 'breaks in presence' (BIPs) was introduced in Slater and Steed (2000). The idea was that rather than only use a post-experience questionnaire to assess 'presence', it could be assessed during the experience itself. The hypothesis was that during immersion in a Virtual Environment (VE) a participant simultaneously perceives two streams of sensory data – from the real world, and also from the virtual world. At any one moment these sense impressions would be the basis of a perceptual Gestalt, corresponding more or less to the world portrayed by the VE or to the real world in which the whole event was taking place. A 'break in presence' is any event whereby, for the participant, at that moment, the real world becomes apparent, and for the duration of that event, the participant acts and responds more to the real world setting than to the virtual world. We concentrate on the relationship between BIPs, reported by the 60 volunteers pressing a wand button, and reported questionnaire based 'presence'. We have simply counted the number of BIPs reported by subjects. Our hypothesis is that the greater the number of BIPs the lower the reported overall presence should be, on the average. The questions of the questionnaire were related to the sense of being in the laboratory or the VE, the awareness of the lab or the VE, which one was more real the lab or VE, the feeling being similar to having seen a movie or visited a real place.

#### **Results**

Under the null hypothesis that BIPs occur at random, unrelated to anything else, the number of BIPs can be treated as a Poisson random variable, and log-linear regression should be used. The most important co-variate is the presence count itself. If we consider a regression of the number of BIPs on the presence score then it is highly significant. The reported presence variable is negatively correlated with the number of BIPs. There is, therefore, a highly significant relationship between the number of BIPs collected during the experience and the presence questions administered after the experience, two variables which in terms of the way they are constructed, should, in principle from a purely procedural point of view, be independent.

Slater, M. & Steed, A.J. (200) A virtual presence counter, *Presence: Teleoperators and Virtual Environments*, 9(5): 413-434.

## (26) Physiological Responses to Breaks in Presence: A Pilot Study

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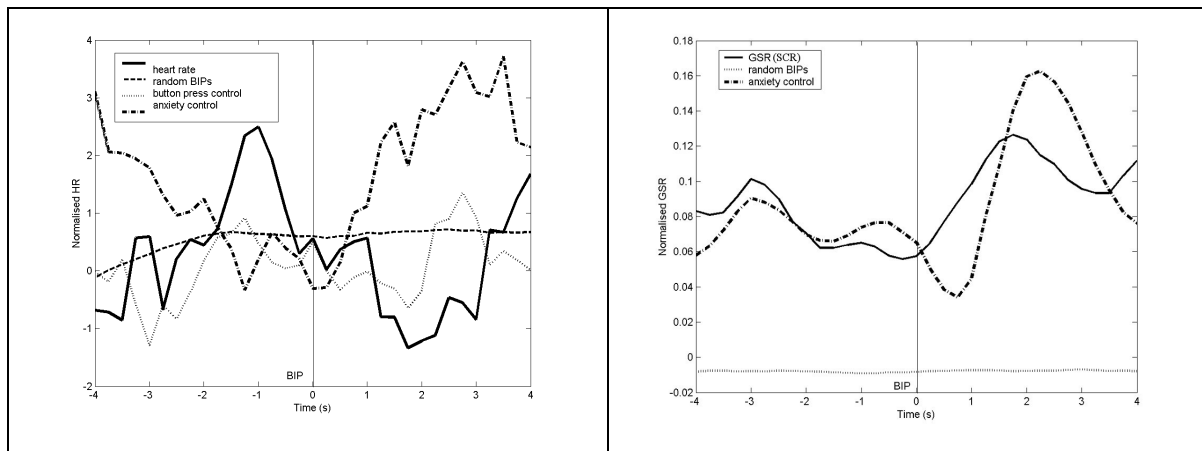
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### Abstract

#### Introduction

A participant in an Immersive Virtual Environment (VE) is subject to two streams of sensory data – from the real world in which the experience is taking place, and also from the virtual world displayed by the virtual reality system. A 'break in presence' (BIP) occurs when the participant stops responding to the virtual stream and instead responds to the real sensory stream. We examine whether BIPs correspond to real changes in physiological state that are detectable in physiological time series. We report on the results of an experiment where subjects reported BIPs in the same way as in Slater & Steed (2000) and where Skin Conductance Response (SCR - GSR) and heart-rate (HR) data were recorded using a ProComp+ device. We find that the evidence does not contradict the hypothesis that BIPs are observable as events in the SCR and HR time series. The evidence was based on 60 subjects for whom heart rate was recorded and 20 for whom SCR was recorded.



#### Results

The graphs above show the mean averaged waveforms within  $\pm 4$  seconds of a BIP, for both heart rate and SCR. For both heart rate and SCR there is a spike either just before or just after the BIP, a pattern which is not reflected in various control conditions, except that related with anxiety.

Slater, M. & Steed, A.J. (200) A virtual presence counter, *Presence: Teleoperators and Virtual Environments*, 9(5): 413-434.

**(27) The Sense of Presence in a sample of patients  
with neuropsychological dysfunctions  
during a VR-enhanced cognitive rehabilitation**

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**Abstract**

Cognitive rehabilitation aims at enhancing the development of skills and strategies necessary to overcome cognitive deficits, overall with persons affected by traumatic brain injuries.

Computer-based tools could enhance the administration of cognitive rehabilitation even if there are a lot of open issues related to efficacy, ethics and ecological validity.

About this last issue, are computer-based rehabilitation procedures useful for patients' everyday life? Is there a realistic and efficacy transfer of knowledge between the tasks carried out in labs and the life outside the hospital?

Among the different computer-based technologies, Virtual Reality plays a key role in the assessment and rehabilitation of psychological functions. But with this new tool, it is necessary to carry on a realistic cost/benefit analysis in order to evaluate which is the added value of VR in different applications in comparison with traditional approaches.

Traditionally VR designers typically aim at creating an engaging environment in which users feel present. The focus for VR developers seems to be "presence" and all the systems to improve it.

The substantial challenge for the designers and users of VR is *how* to use immersive environments to support clinical practice. So which are the core characteristics of a virtual environment in order to ensure a kind of presence that is functional and useful for mental health applications?

The major aim of this work is to show the results of a study related to the measure of the sense of presence using the ITC-SOPI Questionnaire (Italian version, currently under validation) in a sample of neuropsychological patients (with "Frontal Syndrome") during a VR-enhanced cognitive rehabilitation. The results are shown in comparison with a sample of normal subjects.

## (28) Presence and High Fidelity Patient Simulators in Anaesthesiology: Influences Derived From Interviews and Questionnaires

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### Abstract

*High Fidelity Patient Simulators*, are used increasingly in anaesthesiology for different purposes. One goal of a "rational use of simulation" [1] is to "enable" [2] participants to experience presence. To gain an improved understanding of influences on presence in simulator scenarios we conducted an interview and questionnaire study with six anaesthesiologists each taking part in three simulator scenarios after providing informed consent.

Interview results show many influences on the authenticity of scenarios (Figure 1). *Within the scenario* participants' own actions, "role play" of trainers, switching to a meta perspective, technical features and task demands

were mentioned. *From outside the scenario* emotional aspects of the "new situation", group dynamical factors and anticipations towards the setting were pointed out. Questionnaire results show a fair amount of variability in experienced authenticity, despite consistently experienced high scenario plausibility and realistically experienced patient treatment.

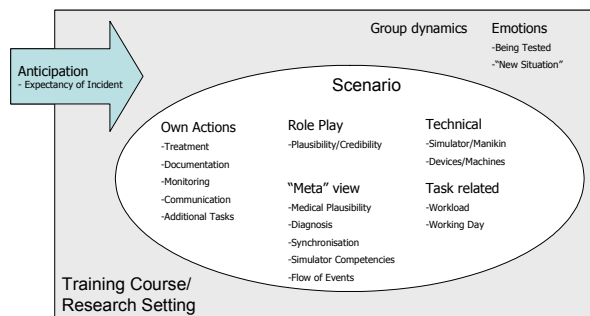


Figure 1: Factors influencing the experience of simulator scenarios

The results are valuable to adapt research on presence to (patient) simulators. Presence during scenarios is influenced by a variety of factors from the simulator setting [3]. Their interplay has to be taken into account according to training and research goals.

### Acknowledgements

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## **(29) Should product involvement facilitate the experience of telepresence? The case of a quasi 3-D virtual store**

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### **Abstract**

Antecedents of telepresence could be classified into three main categories: media content and form features, and the individual's personal characteristics. Although more and more studies focus on media-related causes (e.g., mapping, screen size), there is an evident lack of results on those concerning media user. In addition, if facilitating the experience of telepresence is an explicit purpose for entertainment through new media, more and more designing such experience for business also becomes the goal (for instance, in shopping mall in MUD's). Without any advanced immersive devices (such as head-mounted displays or cyber data gloves), new media's design has to be sufficiently talented to invite a sense of presence on the consumer. Therefore, it would be crucial for companies willing a compelling presence online to deeper understand the individual's characteristics which could "naturally" enhance the experience of telepresence.

More particularly, in the light of the Petty and Cacioppo's Elaboration Likelihood Model, product – enduring and situational – involvements as motivational factors are investigated in order to have some insights to the incremental impact of user variables on the sense of "being" there. To our knowledge, very few research in telepresence-related literature have considered its particular link with product involvement. On the other hand, some pieces of research in social psychology and marketing open the door of considering a possible joint influence between various involvement types (telepresence considered here as another situational involvement type).

A laboratory experiment (two-by-two experimental design) was used to test the hypotheses. The stimulus was a quasi 3-D virtual environment that displays an outside view of a computer store. The sample was composed by 130 undergraduate students with telecommunication background.

The research results have demonstrated that personal relevance toward the brand is likely to facilitate your perception of direct experience with the product and with the environment. In addition, some evidence have been found toward an additive combination model of involvement types (i.e., the total of the individual's involvement is the sum of involvement trait and all involvement states due to the situational relevance toward the brand and due to telepresence) for the particular task assigned to the research participants.

### (30) Experiences with Repertory Grid Analysis for Investigating Effectiveness of Virtual Environments

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#### Abstract

There are many facets to research on presence (Draper et al. 1998), but one key one that has preoccupied the community is measurement of presence response. In this abstract we show how we have used repertory grid analysis (RGA) as a tool to help us understand participants' presence response to virtual environments.

According to the theory of personal constructs (Kelly, 1955), constructs are ways of construing the world, enabling people to respond to what they experience in ways that are 'explicitly formulated or implicitly acted out' (op.cit. p.6). RGA analysis starts by identifying a set of elements of experiences. In an interview, the interviewer picks three of the elements and the participant is asked to pick two and state how they are similar and how they are distinguished from the third. This forms one construct with two poles that characterize the distinction. This is repeated with further triads until no more constructs seem to be emerging. A grid is drawn up in which elements form columns and each construct elicited forms a row. The raw grid is subsequently 'focused' by encouraging the participant to assign a rating on a five-point scale to each element. The focused grid can then be analyzed to find constructs and elements that are similar and explore what characterizes particular elements.

We explored RGA in two pilot trials and are now using it in a study of agoraphobia. In the 1st pilot we were primarily interested in whether RGA would yield useful comparisons between virtual environments. The elements varied from a spacecraft (W1) to a tropical island (W6). Table 1 shows a selection of the constructs elicited. Some of these are not so interesting for the virtual environment designer, but others are related to factors that are considered to be determinants of presence.

**Table 1: Selection of constructs from 1<sup>st</sup> pilot**

|                                    | W1 | W2 | W3 | W4 | W5 | W6 |                                   |
|------------------------------------|----|----|----|----|----|----|-----------------------------------|
| Triggers natural body movement     | 5  | 1  | 3  | 5  | 4  | 2  | No intuitive reaction             |
| Urges discovery of familiar places | X  | X  | 4  | 4  | 4  | 1  | Meets expectation – no surprises  |
| No engaging task                   | 3  | 1  | 2  | 4  | 5  | 5  | More involved, unaware of outside |
| Voyeuristic                        | 1  | 2  | 3  | 4  | 4  | 5  | Interactive                       |

In a 2nd pilot we were able to use the RGA to start to explain the variation in participants' subjective ratings of presence in the environments.

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### **(31) The thematic baseline technique as a means of improving the sensitivity of presence self-report scales**

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#### **Abstract**

Self-report presence scales have received considerable criticism. In our use, we have found that presence scales are insensitive to differences in situations where, according to the literature, presence differences should exist. We believe that one reason why scales lack sensitivity is that many presence scale items require subjects to compare between the VE experience and some standard "real" experience, and then to assign a value indicating degree of match between them. However, the standard experience against which the subjects are to compare against is not well defined. Subjects thus make the comparison on some idiosyncratic basis, which invariably leads to an increase in the error variance of the scale. The sensitivity of self-report scales could thus be improved by providing a semi-standard baseline against which subjects could compare. Finding such a baseline is problematic; for instance, explicit baselines based on system parameters can lead to a blurring of the boundaries between immersion and presence. We suggest using subjects' natural expectations of the VE as a baseline. By priming a subject with materials thematically related to the VE, relevant schemata and scripts will become active, effectively providing a subjective and consistent baseline against which subjects can compare. We tested our idea using a 2x2 factorial ANOVA design ( $n=103$ ). The factors were *stimulus quality of VE display* x *thematic priming*. Thematic priming was manipulated by activating relevant schemata in our subjects by having them examine booklets containing descriptive text and images. We measured presence with two scales - the Slater, Usoh & Steed (1995) questionnaire (SUS) and the Witmer & Singer (1998) Presence Questionnaire (PQ). The SUS showed a significant interaction effect ( $F(1,99) = 10.18$ ;  $p < 0.0019$ ) and a significant main effect on stimulus quality ( $F(1,99) = 9.64$ ;  $p < 0.002$ ). The PQ showed a significant interaction effect ( $F(1,99) = 4.23$ ;  $p < 0.05$ ) and a significant main effect on stimulus quality ( $F(1,99) = 5.99$   $p < 0.02$ ). Post-hoc examination showed (in both scales) a significant difference in mean presence scores between the high and low stimulus quality conditions, but only when subjects were primed with material thematically related to the VE. This suggests that providing a suitable cognitive context can increase the sensitivity of self-report scales; it also provides empirical evidence that presence is partly determined by higher-level conceptual states.

### **(32) Affective Benefits in Communication: The development and field-testing of a new questionnaire measure**

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#### **Abstract**

Awareness systems help people to effortlessly maintain awareness of each other's whereabouts and activities. Rather than the mere exchange of information, awareness systems aim to foster a sense of connectedness. Connectedness is a positive emotional experience which is characterised by a feeling of staying in touch within ongoing social relationships.

We developed a questionnaire measure designed to be sensitive to this dimension of human communication, the *Affective Benefits in Communication (ABC) Questionnaire*. It consists of two main scales: Control (containing the subscales privacy, obligations, and expectations) and Staying in Touch (with subscales thinking about others, situational awareness, connectedness, sharing experiences, recognition, and group attraction). A pilot test with twenty participants showed that the ABC Questionnaire is reliable ( $\alpha=.86$ ).

The ABC Questionnaire was developed in the context of the ASTRA project. This project aims to develop and evaluate a prototype that helps distributed family members to stay in touch with each other. We developed a system that supports the sharing of experiences by sending pictures, drawings and/or short handwritten messages. A field test was conducted to gather data about how people use the ASTRA system in their daily lives. In the field test, we observed the daily communication between related households for one week by means of a diary, questionnaires and interviews. In a second week we observed them while using the ASTRA system.

The results of the ABC show several significant differences: in the second week participants thought about each other more often, felt more aware of the situation of their family members, felt more connected to each other, felt they were sharing more experiences with each other, and experienced higher levels of group attraction. Results from the diaries and interviews confirmed these differences between the weeks.

The results from this study imply that the ABC is a promising measure. Apart from being reliable, it proved to be sensitive to changes in condition. Although validity has not yet been formally established, the correspondence between ABC scores and the interview results is striking and encouraging. Therefore, we believe that the ABC will be a useful addition to the currently limited spectrum of measurement tools in the field of communication.

### **(33) Connecting the Presence's Factors for Guiding Measurements**

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#### **Abstract**

This work presents a model as a first insight to discuss the relationships among parameters that affect presence. It is a step in the direction of delimiting the range of causal relationships for the presence phenomenon, as part of an ongoing research towards a framework for measuring presence.

#### **Presence, media and mediated experience**

According to the paradigm of "second order" mediated experience, we represent the implicit relation between sense of presence and mediated experience as a bilateral relationship. This relationship shows the strong interdependence of these factors in order to obtain the presence phenomenon. This correlation comprises several parameters concerned with presence in a quite complex structure of connections.

#### **The connections among parameters that affect presence**

To start discussing the relationships among the parameters, we need to evince important associations existing implicitly in the correlation above. Considering these associations, we see that they constitute the main entities of the presence phenomenon, based on the paradigm of "second order" mediated experience. The connection between each two of the entities show the relationships among them, represented by an axis. In reality all entities and relationships are interdependent, but what each axis shows is the direct dependence between the factors connected by it, and the indirect dependence when the factors are not on the same axis.

#### **Measurement implications**

What we suggest as main contribution, for this level of diagram, is to group the measurement experiments according to the connections presented. The model can be used to map the measurement of presence determinants onto these guidelines, giving conditions to visualize in which range of relationships the measures are being applied. This leads to identify which variables are directly or indirectly involved in the experiment under observation, what can help to guide measurement efforts in order to make comparisons across studies under the same range of variables. It is a start for defining scopes of measures, defining boundaries among factors determinants of presence and a step in the direction of delimiting the range of causal relationships for the presence phenomenon.

### **(34) Investigating the relationship between presence and emotion using virtual mood induction procedures**

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#### **Abstract**

##### **Introduction**

The following paper describes a study designed to investigate the relationship between affective responses and presence using virtual mood induction procedures within the EMMA project (Engaging Media for Mental Health Applications) part of the European Commission Future and Emerging Technologies Presence Research Initiative. Presence is said to be determined by media form, media content and user characteristics, although little research has examined the impact of media content on feelings of presence. The objective of the current study was therefore to determine the interrelationship of presence and emotion using validated virtual mood induction procedures in a normal population.

##### **Method/Tools**

127 participants from Goldsmith's College, were shown a three minute flythrough of a Virtual Park that was designed to induce either a Sad, Happy, Anxious, Relaxed or Neutral state. Participants were asked to rate how they were feeling prior and post exposure on the Positive Affect Negative Affect Schedule (PANAS: Watson, Clark, & Tellegen, 1988) and a Visual Analogue Scale (VAS: assessing levels of happiness, anger, disgust, relaxation, fear, sadness, and surprise). In addition post exposure participants were asked to remember how they felt "during the experience" on the VAS and were asked to fill in the UCL Presence Questionnaire (UCL-PQ: Slater, Usoh & Steed, 1994) and the ITC-Sense of Presence Inventory (ITC-SOPI: Lessiter, Freeman, Keogh, & Davidoff, 2001). Correlations were conducted between change scores on the PANAS and VAS with the UCL-PQ and the ITC-SOPI.

##### **Summary of Results**

Preliminary validation of the Parks showed that the Sad and Anxious Parks induced the desired mood state. Correlations between the Emotion and Presence questionnaires showed that an increase in negativity when exposed to the Anxious Park was associated with an increase in spatial presence and naturalness. Conversely increases in sadness due to exposure to the Sad Park were associated with decreased naturalness. Associations between non-target emotion states and presence, and also valence and presence were also observed.

## (35) The Gestalt of Virtual Environments

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### Abstract

Our Sensory Environments Evaluation Project uses multimodal design techniques – specifically *Corroborative Detail*, *Coercive Narrative*, and an *Emotional Score* – to help steer the actions and behavior of a participant in a VR environment. Our design philosophy attempts to replicate the *human experience*, by way of its multiple senses and emotional responses, to provide an experience that “feels real”. We want such an experience to be meaningful, cohesive and memorable. We look to emotions as providing salience in both these respects and attempt to evoke them within our design methodology.

The *experience space* includes *sights*, *sounds*, and *smells* comprising the multiple sensory inputs of the *virtual environment*. The participant’s journey can be thought of as a large winding path through this space. Since a participant has free will within that space, our design techniques attempt to constrain his or her actions to those that will provide the best experience, with such constraints remaining essentially imperceptible. We make use of a transitional condition referred to as *priming*, during which the participant’s real world expectations and schemata are “allowed” into the *experience space*. Priming comes from the participant’s life experiences and is also elicited just prior to the virtual experience by the specific instructions given to the user about the VR world. Such priming serves to constrain irrelevant schemata, and becomes a “contextual filter” through which the environment is perceived.

Another technique we use is *Corroborative Detail*, minutiae such as marks of time and humanity (dust, weathering, rust, ambient sounds, smells, etc.) that substantiate believability and evoke the persistency and “feels real” quality of the world. Within our *Coercive Narrative* techniques we include *attractors* and *repulsers* to compel the path of the journey. These are psycho-physical responses as well as actions/reactions promoted both by the *priming* and the design of the world. Given the careful placement of these, the experience of the participant becomes possible to predict.

We augment the predicted emotional responses by what we term an *Emotional Score*. This includes carefully designed emotional cues – specific audio techniques that pervade the entire experience, much like a soundtrack in a film. Such cues include entrainment (synching the user’s heartbeat up to specific rhythms) and the modulations of low frequency sounds (to intensify or mediate the participant’s arousal state). Anecdotal evidence thus far suggests a high correlation of expectations with actual performance. We anticipate our findings will provide insights that will contribute to virtual worlds that more completely simulate the reality of the human experience.

### (36) Emotions and Presence: A dual link

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#### Abstract

A critical point in the theory of presence is its link with emotions. To answer to this question we started from our three layer model of presence (Riva & Waterworth, 2003): *proto presence*, *core presence*, and *extended presence*. Each layer of presence solves a specific facet of the internal/external world separation, and it is characterized by specific properties.

What is the link between presence and emotions? According to our model, the emotional processes influence two of the three layers of presence: *core presence* and *extended presence*.

One of the main activities of the self is to track changes in core affect (feeling good or bad, energized or enervated), in proportion to its rapidity and extent. When this happens, it is critical for the self to focus on its sensorial experience by leaving in the background the remaining neural processes. In this sense, a shift in the level of core affect activates a higher level of core presence, needed to separate between reality and fiction. As underlined by Russel (2003), core affect is not dependent by any reality judgment: it responds to the contents of consciousness whether based on reality or fiction. It is core presence that allows the organism to make this essential distinction.

On the other side, another key activity of the self is affect attribution: the perception of causal links between events. Having extended presence the role of identifying significant experiences for the self, the possibility of an easy attribution (e.g. an easy identification of who is bad or is good in a movie), allows high levels of extended presence. Here, however, the reality judgment plays a key role. In fact, fiction does not activate any instrumental behavior.

In summary, we can expect two level of influence of the emotional processes on the level of presence: (a) a shift in the level of core affect activates a higher level of core presence; (b) an easy attribution of the shift allows a higher level of extended presence.

Moreover, we can expect two level of influence of the reality judgment on the level of presence: (a) Core presence is not a product of reality judgment. Rather, the level of core presence contributes to reality judgements; if we feel high core presence we are more likely to judge events as real. (this mechanism is fooled by VR); (b) Positive reality judgements will tend to increase extended presence.

### **(37) The Virtual Film Crew project – work in progress film making using online communities, computer mediated communication and collaborative VR**

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#### **Abstract**

The Centre for Digital Media and Higher Education at Chalmers University of Technology, Sweden, has initiated a research project investigating how virtual reality collaboration, virtual project rooms and online communication can be used in film making.

Today, film production is a collaborative process spread out over different geographical locations. One of the most common examples is the collaboration between film makers in London, Los Angeles and Sydney. Both small-scale independent productions and large-scale Hollywood productions use collaboration over distance to gather the right mix of professionals for each production. Collaboration over distance is most obvious in post-production, but also script writing, pre-production and even the shooting itself use distance collaboration techniques more and more.

At the same time, digital technology is used more and more often in the production itself, e.g. digital video and digital post-production. The use of virtual project rooms and computer mediated communication such as e-mail, intranets and file transfer become established. What questions arise when the use of these technologies meet the demand to collaborate over distances?

The basic question is, how can all forms of computer mediated communication facilitate film productions, making the production more efficient and stream-lined?

So far, two case studies where independent film is produced using collaboration over the Internet has been thoroughly investigated, and several in-depth interviews have been conducted at post-production studios.

The researchers have also started to investigate different solutions and work flows for using virtual reality during actual shooting. A motion tracked camera operator sees a real time temporarily composite of actors shot in front of a green screen and virtual sets, while 3d modellers and director participates online in a VR environment.

### **(38) Is Velazquez' Las Meninas a Virtual Room ?**

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#### **Abstract**

Sometimes, there is a confusion between reality and unreality. What is considered to be a real presence is an unreal presence for some people and vice versa. This phenomenon is more obvious in the visual arts. What is presented and represented? Velazquez' painting Las Meninas is a good example to study in terms of the artist's presence.

The painting raises many questions about reality and illusion of reality; in another word, what is real and what is unreal in his painting? What seen in the painting is an illusion of reality. The artist has an illusive unique setting to paint: a group of a princess surrounded by her maids of honor and himself. He allows his easel and paints occupy about one third of the painting. At the same time, we don't see the picture inside the picture, we only see its back.

What does he paint? Is it the setting we see? Is it the king and the queen who are reflected in the back mirror? Is he painting himself? Where does he stand to paint his Las Meninas? Is all we see including the artist are considered to be another mirror reflection?

There are many interpretations, but they are always ours; how do we perceive the piece of art? The most valid answer relates the painting to Velazquez' own perception of visual art. Art is the main hero of the painting which is symbolized by the artist, easel, paints, and the artist studio.

Looking at this painting evokes the same feeling of being in a virtual place with virtual people. His studio is full of people, but no one is present, all are busy with themselves, they are there and not there. This is the case in chat rooms; they are not real, only exist in our minds. You meet nicknames and hear many stories and share yours as well. A confusion of reality and unreality occurs to most people. Are you present when you are online? Is what meant by real presence the physical presence or the mental presence?

Velazquez' Las Meninas is about what we neither know nor see. The same case is our feelings to those virtual faceless friends whom we get to know by the new technologies. Although the paper answer some of these questions, some remain ready for further investigations. For my full paper, [click here](#).

### **(39) Place and Placelessness: Designing for Virtual Environments**

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#### **Abstract**

#### **BENOGO**

The BENOGO project is primarily interested in the recreation of virtual, photorealistic places. This immediately raises the question of what do we mean by place? While the term 'place' has generally been used in its everyday sense by virtual reality researchers, it has been defined, explored and developed by a number of environmental psychologists. This paper seeks to draw upon this literature and review its potential relevance to BENOGO and related projects.

#### **Place**

Place is more than space. A place is a particular space overlaid with meaning and a dozen other attributes by those who dwell there, remember that place or have visited it. To create (or more correctly to re-create) a place using virtual reality technology requires more than reproducing its visual appearance but the creation or synthesis of these other factors. To understand the role, dimensions and characteristics of these 'attributes' we must now consider how real places have been studied. The nature of place has been considered extensively in a number of different academic disciplines, the most salient of which for the current discussion being environmental psychology. Environmental psychology has developed models of place (e.g. Relph, 1976; Gustafson, 2001); has studied the development of our sense of place through long term associations with a particular locale (e.g. Hay, 1998) and through the design of the man-made environment (e.g. Stefanovic, 1998) and rather more rarely, how place may be (re-)created by way of artificial environments (e.g. Rohrmann and Bishop, 2002).

#### **Placelessness**

Placelessness – the anonymous hotel room, the fast food 'restaurant' found in any and all Western city centres, the uniformity of artificial environment, if reproduced reasonably accurately in a can result in equally anonymous or placeless virtual environment. This 'inauthentic attitude of placelessness' is due to our 'superficial and casual involvement' with that place Relph (ibid, p.80). "Superficial and casual involvement" seems like a fair description of most people's use of VR systems and the problem of placelessness in virtual environments is not unknown – one consequence of which is difficulty in wayfinding. Again this poses a significant problem for those of us trying to (re-)create virtual places. A place does not spring fully formed from an HMD, it requires interaction, involvement.

## **(40) While Facilitating Presence for Marketing Purposes, Are you Persuading or Seducing your Consumers?**

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### **Abstract**

The capability of new technologies to create media transparency points to a revolution in social communications that involves a fundamental reshaping of the way that people understand the world about them and to the ethical question of whether facilitating immersion contributes to authentic human development. While new media are powerful tools that can enhance human lives by being used for educational and cultural enrichment, intercultural dialogue, and business, etc. these communication media also can be used to exploit, to manipulate, and to dominate.

In the particular field of business, presence is likely to provide companies a very useful tool to encourage whole new genres of experience, which is crucial for creating competitive advantages in the "experience economy". On the other hand, if one recognizes substantial benefits for consumers of being present, others could argue that in exchange for these benefits a greater "psychic cost" exists. In essence, the consumer exchanges his presence in reality for the illusion of non-mediation. This can raise important ethical issues regarding the creation of value for consumers and their freedom of choice when being immersed in virtual reality.

This study examines the legitimacy of facilitating presence for marketing purposes and, more precisely, attempts to answer this following question: "Where is the boundary between effective marketing practice and seduction in using presence?" Seduction is a strategy by which the consumer is induced to tolerate or to overlook unsustainability, or "even to connive in denying it". In order to probe the boundary regions between exchange relationship practices, we use the Deighton and Grayson's framework as a pragmatic ground upon which to set our analysis. This framework is, to our knowledge, the sole comprehensive model defining exchange practices and contrasting seduction and persuasion.

The application of the Deighton and Grayson's framework leads us to conclude that using immersion for the purpose of business in virtual reality implies the possibility of legitimate seduction as well as of illegitimate seduction. These terms are not easy to differentiate because we need to know the marketer's motive: subversion or divertissement. A shared responsibility must exist between the consumer and the marketer. The marketer has to believe that no loss will transpire from the transaction, while the consumer must be aware of the media potentiality and thus not naively enter in such environment. Therefore, model codes of conduct will become increasingly relevant to guide marketers in their practice.

## (41) Virtual Reality as a Mood Induction Procedure

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### Abstract

In the last decades, there has been developed a set of experimental procedures, called "Mood Induction Procedures" (MIPs), whose aim is to provoke in an individual a transitory emotional state in a non natural situation and in a controlled manner; the mood induced tries to be specific and pretends to be an experimental analogue of the mood that would happen in a certain natural situation. MIPs include a broad diversity of methods and have proven to be efficient in achieving these changes in the target mood. We have selected four MIPs: a) "Self-statements or Velten procedure", b) "Music"; c) "Autobiographical recall"; and d) "Fragments of Films".

These traditional MIPs have some limitations, and the magnitude and the specificity of the change vary according to the specific MIP used. We think Virtual Reality (VR) may overcome some of these limitations. For instance, the duration of the induced mood could be longer (more than 15 minutes) and the mood intensity could be higher. Furthermore, it could be useful to induce a range of different moods.

EMMA project (IST-2001-39192) has developed a MIP using VR in order to induce sadness, happiness, anxiety and relax. It has been also included a neutral condition, where no changes in mood are expected. The virtual environment is a park. It has been chosen because it is a "natural" place where other elements (e.g. cinema, music) can be integrated in a believable way. The virtual environment starts with a narrative, which is different according to the mood to be induced. The initial appearance of this virtual environment is the same for all conditions, but the aspect changes soon depending on the mood. For example, in the case of sadness, it is a cloudy day, the trees have no leaves, and so on. Inside the virtual environment, four traditional MIPs are included (Velten, music, fragments of films and self-referent recall)

The first task we are doing at this moment is to validate all the material used in this MIP-VR. Some of this work is just finished. In order to assess mood induction and presence, several measures will be used.

## (42) Dimensions of Presence and Components of Emotion

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### Abstract

Converging lines of evidence from diverse perspectives and methodologies suggest that subjective reports of physical presence (reports of 'being there' in a displayed environment) can be divided into three distinct dimensions. A sense of '*physical space*' may be achieved by providing spatial cues and physical interactions that promote accurate perception-action coupling within a display. Such a display combined with meaningful content will promote '*engagement*' in the user by blocking out extraneous information and focusing the user on important stimuli. The '*naturalness*' of the experience may then be determined by the extent to which media form and media content can be mentally combined by the user to produce experiences and behaviours that appear as if they were 'real'.

A valuable line of research is the investigation of potential causal links between dimensions of presence and components of emotional responses (i.e., experience, cognition, behaviour and physiology). This paper proposes a speculative framework for pursuing such an investigation. Examples of research and theory from the presence literature will be used to support the framework. It is hoped that the framework may be used to 1) identify potential indicators of presence, when underlying processes associated with each dimension of presence may be seen as causes of affective responses, 2) identify determinants of presence, when reports of presence may be seen as a consequence of affective responses and 3) identify occasions when emotional responses and reports of presence may not be associated.

The framework may be useful in the development and evaluation of presence eliciting interactive and immersive interfaces designed to support emotional needs. An example of a future application utilising both presence research and emotion research may be seen in the EU's EMMA project's proposed 'Living Book' application (EMMA: Engaging Media for Mental Health Applications - funded by the European Commission Future and Emerging Technologies Presence Research Initiative). In the Living Book a clinical user may be able to store and retrieve records of emotional experiences, which may be accessed using high-end immersive technologies down to hand-held devices. The proposed framework could aid interactions with such an application by providing predictions concerning the causes and effects of display types, content design and user characteristics.

### (43) Presence and Time Estimation

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#### Abstract

Currently, one of the key questions for measuring presence is whether the relationship between the experience of presence and time duration estimation is positive or negative. I examined the different arguments on the relationship between presence and duration estimation theoretically and then tested it empirically. By doing so, the study aimed to provide some evidence for whether or not duration estimation can be used to measure the experience of presence.

The overall experiment was Presence (3) x Length (2) x Message (4). Each participant heard 24 sounds during the experiment. Presence was classified into three levels, which were low, medium and high, from the rating of subjects on each sound. The stimuli were selected from the sound materials (IADS: the NIMH Center for the Study of Emotion and Attention) so that their norms vary across the arousal and valence dimensions.

A significant main effect of Presence on Time estimation was found [ $F(1, 61) = 9.159, p < .0001$ ]. The relationship was quadratic, with the medium level of presence being the most underestimated and the low and high levels of presence being less underestimated. Next, this study analyzed the relationship separately between time estimation and the two items used to measure presence ("being there" and "it's here") since the correlation between the two was quite low ( $r^2 = .387$ ). This analysis yielded a significant main effect of "Being there" [ $F(1, 61) = 20.276, p < .0001$ ] and interaction "Being there" x Length [ $F(1, 61) = 11.973, p < .0001$ ]. The relationship between "Being there" and Time estimation was negative; the more the participants felt a sense of "being there," the more they underestimated the duration. And the tendency was more prominent for short sounds. For "it's here", this study found a positive relationship with time estimation only when the sounds were long. (Interaction "It's here" x Length:  $F(1, 61) = 4.804, p < .05$ ). The results revealed a complex feature of presence in terms of the relationship with time estimation, which was sensitive to lengths and questions. Further investigations on time estimation as a valid measurement of presence are suggested.

**(44) Persuasive Environments:****Consequences of Virtual Environments on Effectiveness of Persuasive Messages**

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**Abstract**

The present study focuses on structural features of computing technologies, researching the relationship between immersion in virtual environments and the effectiveness of different environmental persuasive messages. Specifically, an experiment was conducted to test the effects of Web 3D content type and presence on attitudes toward ecological products. A 2 (task type; search vs. experiential) X 2 (level of arousal; high vs. low) X 4 (persuasive argument type) X 2 (sound level; sound vs. no sound) mixed factorial design was employed, with level of arousal as a within-participants variable, and task type, persuasive argument type and sound level as between-participants variables. Participants ( $N = 96$ , all college students) in each condition were exposed to four 3D worlds of two different types (urban vs. natural environment) in which 3D models of ecological products or advertisements for ecological products were unobtrusively embedded. After exposure to the Web 3D content, participants' attitudes towards the site and the products were measured. Overall, there were nine dependent variables: presence, cognitive capacity, attention, recall and recognition memory, attitude towards the site, message awareness, attitude towards the product/brand, attitude towards the message, and purchase intention. Cognitive capacity and attention were monitored via skin conductance response (SCR), heart-rate (EEG) and a secondary task reaction time (RT) measure throughout the test period while presence, memory, attitude towards the site, attitude towards the product and message, message awareness, and purchase intention were measured by Likert-type scales that were part of a post-experiment online questionnaire. The results show that two of the independent variables, arousal and persuasive argument type make a significant contribution to the effectiveness of environmental messages. Moreover, significant two-way and three-way interactions have been found, suggesting an important impact of using messages embedded into virtual environments on persuasive outcomes. Theoretical and practical implications are further discussed.

**(45) Virtual Environments and the Sense of Being There: An SEM  
Model of Presence**

Corina Constantin, Dan Grigorovici,

*(Abstract not submitted)*

## (46) What Is Presence and Why It Occurs?

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### **Abstract**

This article reviews previous literature on presence, with particular focus on its conceptualization and typologies. It first compares various types of presence-related terms (e.g., telepresence, virtual presence, mediated presence, co-presence, and presence) and suggests that the term *presence* works best for the systematic study of human interaction with media and simulation technologies. "Presence" is newly defined as "a psychological state in which virtual objects are experienced as actual objects in either sensory or non-sensory ways." Three types of presence—physical, social, and self presence—are defined based on the general definition of presence and the corresponding domains of human experience. Finally, the fundamental reason why humans can feel presence when they use simulation technologies is suggested based on recent developments in evolutionary psychology. Implications of the current explication to the study of presence are discussed.

## (47) Artificial Development Approach to Presence

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### Abstract

We contend that any scientific endeavor of understanding presence should address, at least in part, three basic aspects:

- It should provide understanding of the neural basis of first-person experience and how different cues are integrated to form a holistic perception.
- It should tell what are the physical mechanisms and the conditions that allow these processes to occur.
- It should provide hints of how the sense of presence is formed and how it unfolds over time because of development and/or learning.

We envisaged a multidisciplinary effort where aspects of philosophy of mind, psychology, computer science, and robotics are combined. This effort clearly requires creating synergies and developing a common language and scientific background. In particular, we foresee proceeding along a certain number of steps:

- **Philosophy:** provide a plausible scientific theory of first-person experience. Investigating presence is also seen as equivalent of investigating the nature of **consciousness**.
- **Cognitive development:** the study of development might reveal to be the sole mechanism to shed light on the constituents of the representation of the "sense of presence".
- **Modeling and robotics:** by employing a synthetic methodology we can investigate how the representation of "being there" can be constructed.

These steps are not intended as strictly separate but rather as a possible interdisciplinary synergy. We will report of the current state of advancement of the project and the experiments carried out so far.

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## **(48) Effects of Artificial Developments on Social Presence of Social Robots**

### **: The Case of Sony AIBO**

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### **Abstract**

The current study tests the effect of long-term artificial developments of AIBO on its social presence (co-presence and psychological involvement), social attraction, physical attraction, lifelikeness, para-social relationship with users, buying intention, and users' enjoyments of interaction. Most importantly, the current study tests how feelings of social presence mediate the effect of AIBO's long-term development on other dependent variables listed above. The experiment was a 2 (Number of participants: Individual vs. Group) X 2 (Developmental Capability: Developmental vs. Fully Matured) between-subjects design, with the sets of interaction with an AIBO as a repeated factor. 40 college students in two large introductory courses were invited and participated in the experiment. Participants in the Developmental conditions played with AIBO which develops gradually (from baby to kid, teen, and finally fully matured adult). Participants in the Fully Matured conditions played with AIBO which stays in the fully matured adult stage throughout the four-week interaction. Participants in the Individual conditions interacted with AIBO alone in a lab, whereas participants in the Group conditions interacted with it with other participants ranging from four to five. The results show that the Developmental Capability factor has significant impact on all dependent variables—co-presence; psychological involvement; social attraction; physical attraction; enjoyment of interaction; closeness of para-social relationship; and buying intention. In all cases, the Development conditions positively affect the dependent variables. The Number of Participant factor, however, shows significant differences only in enjoyment of interaction and closeness of para-social relationship. In both cases, the Group conditions positively influence the dependent variables. In addition, no interaction effect between the two factors was found. A path analysis was conducted to test the mediating effect of social presence on other dependent variables. The path analysis provides very strong evidence that feelings of social presence mediate the effect of AIBO's long-term development on other dependent variables such as attraction, enjoyment of interaction, lifelikeness, closeness of parasocial relationship and buying intention. Finally, we discuss implications of the current study to social presence research and human robot interaction literature.

## **(49) The factor structure of the Networked MINDS**

### **social presence measure: a comparison**

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#### **Abstract**

To further expand the factor structure of social presence, "the sense of being together with another intelligent being," the Networked Minds social presence measure was tested in a drunk-driving prevention communication program to assess the users' perceived social presence of the agent who acted as a guide. The factor analysis was performed to further determine the underlying dimensions and factors composing of social presence.

#### **Four Dimensions**

An earlier study by Biocca, (2001) put forth three dimensions and 8 factors in the factor structure of social presence. The three dimensions and factors associated with each are: Co-presence (isolation, mutual awareness), psychological involvement (attention, empathy and mutual understanding) and behavioral engagement (behavioral interdependence, dependent action and mutual assistance).

The current study however, revealed four instead of three dimensions with attention allocation standing out of the psychological involvement dimension as attention allocation may be treated as an independent cognition dimension.

#### **Nine Associated Factors**

The factor analysis results also suggested different factors indicative of the three dimensions that both studies have in common. Mutual awareness was broken into two specific factors: mutual awareness between the users and the agent, and the mutual awareness between the user and the others in the environment. The empathy and mutual understanding factors in psychological involvement were retained while attention allocation separated from the psychological involvement dimension and broke down into two factors: attention and distraction.

For behavioral engagement, instead of having one single factor indicative of behavioral interdependence as in the Biocca's study, two interrelated factors emerged: 1) how the user's behavior was dependent on the animated character's behavior, 2) how the animated character's behavior was dependent on the user's behavior.

**(50) Contribution of interactive 3D sound to presence**

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**Abstract**

Notions of presence and space are intermingled. Therefore, even if vision is known to provide accurate space perception because of its resolution, audition should give rise to a better sense of presence because of its continuous access to the whole 3D environment. Spatial organisation of an auditory scene is built upon different acoustical cues such as source localisation, source directivity and room effect. When these cues are provided and interaction is allowed, high levels of presence can be easily reached.

We conducted several experiments in which different techniques of 3D audio were used. In one case, wave field synthesis (WFS) was used in a situation of mixed reality, to assess distance perception. In another case, binaural techniques were incorporated to a visual VR setup. In the last case, binaural techniques were used in a wireless auditory VR setup. Thanks to the properties of WFS, allowing the reproduction of a sound field in an extended listening area, source localisation could be accurately evaluated by subjects through dynamic exploration of the soundscape. In the second case, subjects were submitted to a navigation task and did perform better when 3D audition was added. In the last case, despite the absence of visual stimulation, subjects managed to build an accurate cognitive representation of an auditory virtual environment. Subjects performances in these experiments were taken as an index of presence together with behavioural reactions to the VE, debriefing with the subjects, and presence questionnaire scores.

From these different experiments, we propose that the following elements do contribute to the sense of presence in an auditory virtual environment (VE): intra-congruency of the VE, whatever the properties of the VE – artificial or realistic, quality of the scenario (VE), number of factors giving information on the elements constituting the VE (room effect, directivity),... Different acoustical cues can be used to provide a better sense of space, while such diversity does not exist in the visual domain. For this reason and because of the absence of restriction in the addressed receptive field, audition shows primacy among sensory modalities to promote presence in VR.

## **(51) SoundScapes – A concept and methodology of "Being There"**

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### **Abstract**

Soundscapes is the title of an on-going design of an adaptable creative interactive environment system that is at the core of the author's human performance system concept. It includes suggested cognitive and perceptual mechanisms that underlie possible optimised stimulation of the sense of "Being There" - the "active" and dynamic perception of such environments, and the alternative design methods that place the human being at the centre of the design paradigm so as to give opportunity for improved quality of life. The user groups are initially the disabled and those in (re)habilitation.

Experts within human movement suggest such optimisation is through the resulting closure of the human 'afferent efferent' neural loop. The increased motivation involvement and predictable emotional expressive cues are then achievable through a tailored (to each user) interactive environment that is capable of the attainment of the desired "presence" state for the user. The core of the system is mapping of body function data (mostly movement) to multimedia multi-sensory feedback in real-time so as to achieve immediate causal response. Such mapping is through sourcing the body function data through sensors and/or cameras which enable a non tangible low latency interaction that is non-impeding for the user. The mapping of the data to the environmental multimedia feedback is through knowledge of the user's desires, preferences, and limitations so as to stimulate the user to "push their limits" of the interaction through self-motivation. This mapping can also be a visual representation of the 'self' (through camera sourced video blends/blue screen technology or a 3D avator/model). Game scenarios are utilised where similar desired user immersion states stimulates the conviction and motivation for interaction through control of certain aspects of the feedback; here, the user is focused on the feedback in order to successfully create the (conscious and/or subconscious) interaction rather than, for example, on a body part that gives pained movement.

It is anticipated that this contribution will stimulate discussion relative to the use of the various technologies used to create the desired state of 'presence' resulting from non-intervention techniques in IT (Interactive Therapy). Hopefully it will also assist similarly interested practitioners and researchers in the networking towards the future evolution of such human 'quality of life' issues and relative interdisciplinary research in the field.

**(52) Sometimes I Really Hate Coming Back to this World:****Presence and On-line Video Game Playing**

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Today's technology allows people to play video games together in shared mediated spaces, either by playing on-line or by networking their videogame consoles. This environment is similar to other collaborative environments, in the sense that players agree to meet in a mediated space and often work together in teams to meet the objectives of the games (e.g., to capture the other teams' flag, or to kill all the other teams' players). These collaborative environments, which exist solely for entertainment purposes, have to date not been explored by presence researchers. Three focus groups were conducted to investigate the sensations of presence experienced by gamers while playing with others. The study included questions about both spatial (physical) and social presence. The results revealed that participants in these collaborative environments (i.e., videogames) do experience a variety of presence sensations. Players reported feeling sensations of immersion, perceived realism, social richness, and social presence. Additionally, the players reported experiencing a sense of co-presence. The implications are discussed.

## **(53) AM3D – True 3D Audio algorithms**

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### **Abstract**

#### **Demonstration of AM3D 3D Audio technology**

The best way to demonstrate 3D Audio is to get the audio into your ears. You can experience the quality of Diesel Power™ in our demonstration tool Diesel Studio at our booth.

#### **The company**

AM3D ApS is part of the Nordjyske Group, which has a history dating back to 1767, and now employs 1000 people within newspaper, radio, television, new media, research and development.

AM3D has since 1999 in cooperation with AAU, been deeply engaged in developing and making tools to reduce reaction time and to improve situational awareness for mission critical systems. For e.g. the pilot real-time information about direction of and distance to hostile missiles or fighters is of great importance. Separation of sources is necessary to the extent that information about more than one object is needed. Positional data typically comes from a self-protection system based on radar information that contains reliable information about direction and speed. The pilot perceives audio information through the two-channel binaural signal of the headphones with real-time update of the relative direction of the object, and the pilot can instinctively rely on the perceived direction of the object. Trials of the 3D Audio System are today taking place in different fighters and flight simulators: F-16, JAS-39 Gripen, the Lockheed-Martin advanced Joint Strike Fighter and the Apache helicopter, at latest flight testing has been accomplished in a Swedish jet trainer (SAAB 105), in a government to government program.

A software developer's kit for game developers and middleware producers is available. The product contains true 3D audio positioning based on binaural synthesis, acoustical modelling and audio streaming management for both headphones and loudspeakers.

The HRTF dataset used by AM3D and the measurements of transfer filters guarantee a high quality in the sense of localization performance and naturalness in the reproduction of the virtual image. Aalborg University started in the early nineties investigating this area and has maintained their focus on human localization abilities using binaural technology. The research activities have led to comparison between real-life localization abilities and individual HRTFs, generic HRTFs and HRTFs based on in-house developed artificial head called "Valdemar".

## (54) Demonstration

### BENOGO: Being There Without Going

EU/IST/FET project no. IST-2001-39184

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#### Abstract

The BENOGO project runs from 1 October 2002 to 30 September 2005. The project explores the use of Image-Based Rendering (IBR) techniques for real-time photo-realistic visualization of *real* places. As opposed to standard computer graphics visualization techniques, IBR does not require accurate 3D modeling of an environment before it can be visualized. Instead IBR uses systematically acquired sets of real images of an environment, which is subsequently, and in real-time, re-mapped to the view of the observer so as to allow the user to experience moving around in the scenario for which the images were acquired.

The main advantages of the IBR technique are that no 3D modeling is required, and equally importantly that the observer experiences a photo-realistic scene. The disadvantages of the IBR technique are that in general very large sets of images are required and the technique has high computational and memory expenses. The BENOGO project is developing the IBR technique to overcome these disadvantages but at the "cost" that the resulting views are not perfectly perspective. The project thus uses psychophysics knowledge and extensive presence measurement evaluations and research in order to tune the technology so as to optimize it for mediating a sense of presence in a recreation of a real environment.

The project is additionally exploring techniques for augmenting the scenarios with sound scapes to enhance the feeling of presence. Furthermore the project is developing techniques for augmenting scenarios with virtual objects in order to add movement and later interactivity to the otherwise static IBR scenarios.

The demonstrator will show examples of the present state of the project's technology. More specifically there are two different demonstrators, namely 1) a high resolution scenario where the user only has freedom to look in different direction but cannot move, and 2) a lower resolution scenario where the user can move freely within approx. 0.5 meters and look freely in every direction. Visitors at the demonstration will be able to experience **being** in places such as a beautiful hall in Prague, and a programmer's office late at night **without going there**. Additionally visitors will have a chance to compare an IBR and a real version of the same scenario, namely the conference site.

## (55) Physiological Recording Device for Presence Research <sup>++</sup>

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<sup>++</sup> This work is partly funded by the EC project PRESENCIA

### Abstract

The purpose of virtual reality (VR) systems is to give the illusion of being in a different place rather than the real world. The illusion of being somewhere else is essential for the effectiveness of VR. For this illusion or subjective experience, the term presence has been defined. Presence shows the level human respond to a virtual environment (VE).

There are two aims that should be solved. The first one is to construct a physiological monitoring device to measure the level of presence in an objective way and the second one is to feed neuro-physiological parameters back to the VE. This allows to investigate effects of the VE on the subject and to modify the "flow" of the VR by the subject's physiological responses. This combination allows to use the system for various kinds of therapies and for medical displays. Furthermore the feedback of brain activity enables the subject to control the VE just by thoughts. Such a device is known in the literature as EEG-based Brain-Computer Interface (BCI).

A corresponding biosignal amplifier for the acquisition of EEG, ECG, EMG and EOG signals was developed. Furthermore, the system allows the acquisition of blood pressure, skin conductance, respiration, pulse and external signals (e.g. switches). The recording device has additional inputs for the synchronization with the VE. After amplification the biosignals are passed to a PC/notebook and to the **Feature Monitor** for raw data acquisition and visualization. The Feature Monitor extracts on-line the heart-rate and the heart-rate variability out of the ECG channel. From the EEG signals the compressed spectral array and cerebral function monitor signals are calculated. All parameters are displayed on the Feature Monitor window during the experiment and give a time compressed report of the experiment. The recorded raw-data can be used for off-line analysis.

Additionally the **Real-Time System g.RTsys** allows real-time parameter extraction and classification of EEG data for feedback and for BCI applications. The BCI allows just by imagination of e.g. a left or right hand movement to realize a 2 dimensional control. The BCI calculates bandpower values of 2 EEG channels in the alpha (8-12Hz) and beta (16-24Hz) regions of the EEG. This bandpower estimates are classified by a linear discriminant analysis yielding a control signal that can be used to control the VE.

## **(56) AddVisor™ 150: A High-Resolution, Stereoscopic AR/VR Head Mounted Display**

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### **Abstract**

#### **Demonstration of the AddVisor™ 150 Head Mounted Display**

The AddVisor™ 150 Head Mounted Display will be demonstrated in the exhibition area during the Presence 2003 conference.

#### **Main Features**

The AddVisor™ 150 is a new state-of-the-art head mounted display designed to meet requirements of high-end augmented and virtual reality applications. Main features include:

- superior image quality
- stereoscopic viewing
- low weight and excellent comfort
- see-through and non-see-through operation

The attractive and ergonomic design of the AddVisor™ 150 head set features easy access to user adjustments including interpupillary distance, brightness, brightness balance and audio volume as well as mounting points for most common head tracker systems. The head fitting system features a patent pending design for easier adjustment to the individual head size.

#### Brief technical data

|                     |   |
|---------------------|---|
| Field of view:      | 36 x 29 degrees at 100% binocular overlap<br>54 x 29 degrees at 50% binocular overlap |
| Focus:              | 0,6 – 25 m  |
| Definition:         | 1280 x 1024 full colour pixels per eye  |
| Colour depth:       | 24 bits   |
| Display media:      | Reflective FLCOS  |
| Binocular distance: | 0,6 m - $\infty$  |
| AR see-through:     | > 30%   |
| Headset weight:     | 1 kg  |
| Video input:        | Dual 60 Hz SXGA, digital or analogue  |
| Options:            | Trackers, stereo audio earphones, microphone,<br>head mounted cameras                 |

## (57) McLuhan, Heidegger and Presence Research

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In the context of presence studies and research, both Marshall McLuhan and Martin Heidegger's study of the psychic and social effects of media technologies provides fertile ground from which to better understand how human artifacts mediate our lived experiences. For McLuhan, it is his analysis of synesthesia, figure/ground, environment/anti-environment, and tetrads that provide several tools with which to evaluate and identify the ontogenic dimensions of media, that is, how they transform, enable, and generate our realities. For Heidegger, philosopher of the experience of "Being," a technological mode of existing means that technology simultaneously reveal ("undisclose") and conceal ("disclose") aspects of that existence. Neither technophobic nor technophilic, however, both theorists accept our technological "destiny" while advocating the need to critically think through how we can absorb modernist technologies' impacts (Heim, 1993). In other words, both feel that authentic living in an innately technologized world means fundamentally understanding the patterns of the technological and the ways it structures our mentalities and our lifeworlds.

It is McLuhan's tetrad which offers a means of freedom from becoming the 'servomechanisms' of our technologies. The tetrad, which postulates that all human artifacts enhance, obsolesce, retrieve and reverse into something else, is fundamentally, "exegesis on four levels, showing the logos-structure (not mythos) of each artifact; its four parts as metaphor or word. This is to place for the first time the whole study of technology and artifacts on a humanistic and linguistic basis, one which is 'valueful' rather than 'valueless' (McLuhan & Powers, 1989). Tetradic analysis is McLuhan's pentultimate 'theory,' or method, of inoculation from, and recognition, of media effects. It cultivates pattern recognition, the return to equilibrium, and allows us "to see "and-both" the positive and negative results of the artifact" (McLuhan & Powers, 1989). In the course of our paper, the evolution of the quaternary or tetradic structure is discussed illustrating its relevance in the context of presence research using the contributions of such philosophers as Aristotle, Pythagoras, Kant, and Nobel Laureate Wolfgang Pauli.

Grounded in Heidegger's concepts of "equipmentality" and "being-in-the-world" and Merleau-Ponty's phenomenology of the body as a locus of worldly encounter, existential phenomenologist Don Ihde's four-fold framework of human-technology relations (1990) can help us understand the spectrum of amplifications and reductions intrinsic to the technological mediation of our lifeworld. Viewed through McLuhan's theories of figure/ground and the tetrad, Ihde's structures of human-technology relations phenomenologically describe the ways mediational technologies interplay with our sense of presence and the varying gradations of perceptual gains and losses inherent in technologically mediating processes.

Cumulatively, McLuhan's discourses on synesthesia, figure-ground, environment/anti-environment, and tetrads, and Ihde's interpretation of technologically mediated reality as seen through Heidegger, provide a complex and rich body of research from which to examine the 'presence' of media and their effects on our lives.

## **(58) ERRONEOUS PERFORMANCE DURING DROWSINESS AS SWITCH OF PRESENCE BETWEEN INTERNAL AND EXTERNAL WORLD**

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Now many authors believe, that sense of presence could appear in three cases: in a real world, in a virtual world, and in an internal mental world. Riva and Waterworth (2003) suppose that presence is the result of the evolution of the central nervous system in its attempt to embed the sensory-referred properties into an internal functional space. As noted by Waterworth and Waterworth (2003), the appearance of the sense of presence allows the nervous system to solve a key problem for its survival: how to differentiate between internal and external states. In our opinion, the essential contribution to development of neurobiology-based theory of presence can be brought by studies of sleep/wake transitions. During the period of drowsiness there is a change of a state of consciousness at which the attention is switched from external environment to internal information processes that rather frequently is accompanied by occurrence of hypnagogic images. We have developed continuous psychomotoric test carried out with closed eyes. Visual sensory isolation (closed eyes) from surrounding real world caused quick development of drowsiness and the appearance of erroneous performance. A level of presence in a real world was estimated by continuous performance of test (self-pacing button pressing). Healthy subjects ( $n=64$ ) participated in experiments ( $n=280$ ) and EEG, ECG, EOG, skin conductance response (SCR) and button pressings were recorded. The error onset was shown to be preceded by the EEG "drowsy pattern" and decreased in the rate of spontaneous SCR. The performance reappearance after the self-detected error was accompanied by phasic SCR and alpha-burst of EEG. When participants spontaneously self-activated and renewal of proper performance, he/she reported about "...lost in thought" and dream-like imagery and after that announce of the perception of the errors. The interval between the error and the first following SCR (mean 10.1 s) was significantly ( $p<0.001$ ) shorter than the interval between the error and the last preceding SCR (mean 69.8 s). It is supposed that the subjective perception of an error is a significant endogenous stimulus which evokes the orienting response (OR) and accompanying by SCR - sympathetic activation. The spontaneous restoration of performance and self-detected error is an analogue of the break out of their state of presence (BIP) in "internal worlds" to back to the "real world" (Slater & Steed, 2000). These moments when individual switches from one interpretation of environment to another, are of particular interest. If it could be known when and why it occurred, this would be a major contribution to the problem of eliciting the factors that enhance or inhibit the sense of presence. We also believe that our approach to BIPs measuring by physiological registration of phasic OR components might be used for the analysis of performance in the virtual world.

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# Welcome to Presence 2003 in Aalborg

