Presence: Research Encompassing Sensory Enhancement Neuroscience and Cognition with Interactive Applications

Aims

PRESENCIA is an EU FET project that has run over three years. The starting point was a theory of presence rooted in visual perception. We gathered data beyond after-the-event subjective reporting, using brain imaging and physiological recording studies in an attempt to characterise and understand the presence state. In addition to functional brain imaging we also characterise presence based on the assumption that the degree of presence in an environment will covary with the ability of that environment to induce bodily changes. We exploit brain plasticity allowing participants to accomplish tasks such as locomotion by 'thought'. Finally, we enhance sensory information by visualising communicating people with information beyond what is accessible with the normal senses - to show aspects of their affective and physiological state. We examined the impact of this extra-sensory visualisation on co-presence and performance.

During the course of the project we have developed a new concept termed *correlational presence*. Our observation is that people (the brain) are very sensitive to correlations between their own actions and the feedback they get from the environment through their senses. This includes both internal feedback (proprioception) and external feedback. An important aspect of the approach in the research of this project is that presence may be enhanced through statistical correlation between activity and sensory feedback at many different levels.

Partners

Mel Slater, Anthony Steed
Department of Computer Science, University College London, UK **(Coordinator)**
Presence Theory and Experimentation

Ray Dolan
Institute of Neurology, Functional Imaging Lab, University College London, UK
Brain Imaging Studies

Miriam Reiner
The Department of Education in Technology and Science, Technion - Israel Institute of Technology, Israel
Haptics

Maria V. Sanchez Vives
Instituto de Neurociencias, Universidad Miguel Hernandez-CSIC, Spain
Behavioural and Neurophysiological Studies

Gert Pfurtscheller
Institute for Biomedical Engineering, University of Technology Graz, Austria
Physiological recording system and HCI

Christoph Gruger
g.tec guger technologies, Austria
Physiological recording system and HCI

Demos

A number of demos of research from the Presencia project will be shown during the Presence Conference including the following.

Navigating the (Virtual) World by Thought

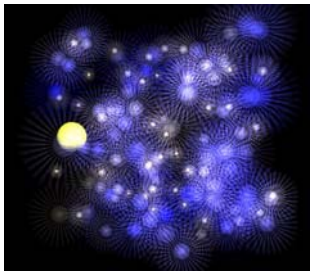
This demo illustrates the (first ever) experiment in integrating brain-computer interface (BCI) with a highly immersive VR Cave. The subject will be able to move forward and backward in a virtual street, using imagination of hand and feet movement. The subject will be wearing an EEG electrode cap, connected to a biosignal amplifier. The Graz-BCI system analyses the EEG signals in real time and classifies the thought patterns. These are then passed on over the network to the software running the VR simulation in the Cave.

Correlational Non-verbal Communication

This demo illustrates a study on the effect of non-verbal communication on interaction with a virtual human. The character is able to respond to the behaviour of a real human. This response mirrors the kind of responses that occur in real conversation, responses to the persons movement and speech. The character is also able to respond to the humans heart rate for a different type of interaction. The study investgates the effects of these responses on presence

A Correlational Physiological Virtual Party

This demo will illustrate our experiment in a VE that correlates in real-time to the subject's physiological signal. The subject visits a virtual bar room and interacts with some virtual characters. The subject's physiological signals (specifically heart rate, heart-rate variability, galvanic skin response and respiration) are recorded and analyzed in real time during the experiment. They are then fed into the Dive software controlling the VE. Several aspects of the VE change subtly according to this real-time channel (we will let you try find out for yourself what exactly changes...). This is part of our research on correlational presence.



An Abstract Correlational environment

In this project a subject is tied to a virtual space by virtue of their position in the CAVE, their actions, and the their body physiology. The environment, an emergent/responsive system of particles, is generated according to subjects conscious control of actions and the subconscious responses of their body.

Virtual Attraction

In this demo a female avatar flirts with the user in a virtual bar. The avatar's movement, gaze, and speech have been designed to give the user the experience of a pleasant virtual encounter. A future experiment will measure the change in the user's galvanic skin response, heart rate, and breathing as UCL's friendliest avatar invades their personal space. This is also a part of our ongoing research in the possible use of virtual environments by psychologists to treat conditions such as social phobia.