The autoscopic flying avatar : a new paradigm to study bilocated presence in mixed reality

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ABSTRACT
This position paper presents the project "Becoming Avatar" deals with avatarial immersion [1] addressed through an interdisciplinary experimental approach. Its goal, at the crossroad of the creation of images and interactive technology, of virtual reality, neurophysiology and information and communication sciences, is to develop a device and a media scenario to support the hypothesis of a split state and to objectify the situation of bilocation [2]. Being present both here in front of the screen and over there, beyond the screen, which is shown by empirical studies of video games and by artists and metaverse explorers in *Second Life*. This type of state resonates in neurophysiology with the artificial "Out-of-Body Experiences" sensations produced with the aid of virtual reality equipment on healthy subjects.

The production includes the development of a scientific experimental facility for physiological measurements and a public installation allowing someone to live a non-ordinary experience of split self. The common feature to both aspects of the project is based on the original idea of integrating video and 3D technology in order to experiment a situation of flight in mixed reality. The subject is literally invited to "become an avatar", indeed, he sees his own image, filmed from behind, inlaid into a synthetic world where he will be able to move freely and experiment different events. This autoscopic system of immersion was imagined in 2012 by E. Pereny and worked again in 2013-2014 with Pr A. Berthoz and E.A. Amato, to be developed and finalized with N. Galinotti and G. Gorisse, with Jams sessions integrating students.

Categories and Subject Descriptors
Human computer interaction (HCI), Interaction paradigms, Mixed reality, Emerging technologies, Emerging interfaces.

General Terms
Measurement, Performance, Design, Experimentation, Human Factors, Theory.

Keywords
Avatar, Image, Presence, Immersion, Physiological measurements, Chroma Key, Autoscopy, Third person perspective, Real-time 3D, Instantiation, Experimentation.

1. EXPERIMENTATION PROPOSED
To describe simply the experimentation we propose, we shall now introduce its basic scenario: the free flight. At the beginning of the session, the subject is facing a green curtain with a head mounted display. Then, the screens before his eyes are switched on, he is now seeing a virtual desert landscape with mountains and a glowing sky where the clouds are drifting. Suddenly, his perfectly cutout body, filmed from the back, is appearing, standing in the middle of the landscape. When the subject is moving, and because of the real time reacting of the image, he is realizing that he is like a 3D avatar viewed in third person perspective. He hears the instruction to lift his arms, which will cause the take-off of his body few meters above the ground.

Then, the image of the subject body seems to bend forward, although he himself remains right straight up, which initiates a general scrolling of the landscape. Then starts a learning phase which will train him to navigate in the landscape. Indeed, using his arms, the subject can induce the movement of his avatar to turn right or left, go up or down, depending on their orientations. After having some time to enjoy the sensations procured by this flight activity, he will have to face different events, tests or tasks that will allow him to experience the emotions of this split state situation in this mixed reality. Several physiological parameters will be measured during the experiment.

Figure 1 : The subject is equipped with physiological sensors during the experimentation.

2. PROBLEMS AND STUDIES

From the perspective of art and interactive image technologies, the installation is asking a particular aspect of the relation to these RT3D artificial worlds by focusing on their iconic nature [3], including Avatar [4], here rendered directly in video, and on the coupling between the image and the controls of a cybernetic system. These three aspects are studied through an action in situ, with the presence of the human subject in the picture. Thus, it should be possible to objectify and characterize these pictures who become livable spaces and theaters of action, as well as the fundamental mechanisms of interactive imaging devices, including video games and virtual reality. Or even to map the mechanisms of presence and agentivity in situations of bi-location. This new situation of ubiquity, where we are simultaneously here in front of the screen, and over there beyond in its electro-digital dimension, could help to review the effectiveness in virtual worlds, commonly sought.

To describe this immersion, video game studies propose the term of co-instantiation [5], which would be equivalent to projection for cinema. Within the playable sphere, the situation becomes much more complex because different identifiable corporeities are distributed not only on the two sides of the screen, but also within the screen, which becomes the control and management interface. All points of view are often mobilized, from the first to the third person perspective, while articulating, for narrative purposes, interactive vision and "cinematics", pre-calculated scenes imposed by the machine. In this field, one of the question is the excessive media attachment, the addictive behaviors with an "avatarial existence" and the virtual worlds opposing the real worlds that would be first and foremost one the basic effects of the ludic device. More widely, the avatar seems heuristic [6] for understanding recent developments of the Information Technologies and Science concerning the growing place of the body in the man's relationship with the machine.

As for neuroscience and virtual reality, the installation "Becoming Avatar" offers a paradigm, called "the flying Avatar", order to improve the understanding of the neural basis of the existence of a double of ourselves which has been evidenced in neurological pathologies and in recent experimental paradigms. The RT3D and the use of avatars had been a privileged solution to experimentally address this question [7]. Indeed, we know that the human brain has a representation of the human body called "Body Schema" often distinct from another mechanism, "Body Image". There is a large neurology and neuropsychology literature describing the functions, as well as the pathological manifestations of the body schema. The fact that we have in our brain a double of ourselves is also well illustrated by the dream and the feelings of ghost limbs [8]. We know that these are the specialized areas [9] (parieto-insular cortex and temporo-parietal junction) of the brain that are involved in a privileged way, both in the multi-sensory fusion and in the construction of this body schema. The same area are involved in the relationship between body and space, or in the representation of the gravity acceleration and therefore of the orientation of the body relative to gravity, which is one of the function of the vestibular system. Furthermore, Neuropsychology data describes the role of these areas in the phenomena of autoscopy, heautoscopy and out-of-body experiences, which are today studied by neurologists. Finally, it was shown that these areas are also involved in the relationship with others and empathy [10].

3. METHODES AND PERSPECTIVES

Finally, it is useful to emphasize the research-creation method that we are implementing with the researchers involved in this scientific cooperation between the University of Paris 8, the *College de France* and the *Conservatoire National des Arts et Métiers*. We called our approach techno-social because it takes advantage of the availability and maturity of technology in order to invent their socialization through the creation of original content, materialized through experimentation and technical devices [11]. The preparation and the production are interdisciplinary, but the resulting objects are transdisciplinary, leading to new uses in innovative or classical domains. The originality, assumed by the leaders of this project, is to combine both research and education, including students of different levels, and experiment iteratively various situations with the public to make theoretical advances.

A derivative of the experimental installation may be useful for diagnosis or even remediation of cognitive deficits in pathological identity or visuospatial functions, as well as for training in weightlessness situations or humanoid tele-robotics. The public installation, beyond the reflexive experience and the technical relationship will be proposed in technology exhibitions and could also lead to adaptations in the field of entertainment or in popular science venues such as the *Futuroscope* or the *Museum of Science and Industry in Paris*.

4. ACKNOWLEDGMENTS

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