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Being Inside the Image. Heightening the Sense of Presence in a Video Captured Environment through Artistic Means: The Case of CREW.

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Abstract

This paper explores the use of omni-directional video, a high impact immersive medium, by a performance group and multi-disciplinary team of artists and scientists. CREW develops artistic strategies from and for this technology that lead to unprecedented levels of presence and intimacy as well as novel ways of mixing and experiencing different levels of reality. We argue that sensorial deprivation *is a key element in creating a sense of presence in a video-captured world and use* synaesthetic negociation *as a concept to describe our tendency to unify the different sensorial stimuli to a coherent and meaningful experience. In reconfiguring the overall sensory, mixing physical stimuli with live and prerecorded stimuli, different levels of reality seem to blur, opening up the embodied experience of a transitional environment.*

Although these findings were not derived from a scientific research set-up in the traditional sense, we argue that the artistic practice as performed in close collaboration with scientists offer particular insights to the research on presence.

Keyword--- **Immersive Technology, Performance, Virtual Environment, Sensorial Deprivation, Embodiment, Transitional Space**

1. Introduction

Presence has been a key concept for understanding the effectiveness of virtual reality. It's a psychological phenomenon that has been defined as the participant's sense of 'being there' in a virtual environment (VE). It is a mental state in which a user feels physically present within the computer-mediated environment [17] It has been widely argued that the interaction with this virtual world on various levels is an important source of presence, stimulating both the bodily and cognitive activity of the user [15] .

In this paper we explore the use of ***omni-directional video*** (ODV), a new immersive medium that allows the spectator a surround video display by means of a head mounted display (HMD). Equipped with an orientation tracker this HMD shows a sub-image of the panoramic video that corresponds with the spectator's view direction and desired field of view. The visual and spatial characteristics are different fromVirtual Reality (VR) where the user is immersed in a synthetic designed world. ODV places the viewer physically in a video-captured image, generating an environment more true to live. Moreover, the filmed image becomes a space in which the viewercan walk around. The virtual space coincides with the embodied own space, integrating thus the story world into the physically perceived world of the spectator. In this sense, it is similar to what we today know as Augmented Reality (AR), an environment that includes both virtual and real-world elements [1] [13] . But VR and AR are computer-generated environments, whereas ODV is a video-captured environment, mingling prerecorded with real-time filmed images, creating a transitional world between different levels of reality (Mixed Reality).

First we will shortly introduce the work of CREW, the live art company at hand. Their artistic practice focuses on mingling different layers of reality, to immerse the spectator in what we propose to call a ***transitional space***. Then we will describe the immersive technology developed for these performances by EDM/UH (the Expertise Centre for Digital Media, University of Hasselt, Belgium). Through the creation of these immersive performances CREW managed to obtain a range of artistic and dramaturgical strategies that proved by experiment to cause a high degree of presence.

The goal of this contribution is to point out some of these artistic immersive strategies. Focusing on the latest performance EUX, we will argue that ***sensorial deprivation*** is the key to the realm of the virtual. The disordering of the senses causes a perpetual ***synaesthetic negotiation*** in order to reconnect different stimuli into a coherent whole. This immersive practice asks for a multi-layered, processual notion of presence.

2. CREW the company

As a performance group and multi-disciplinary team of artists and researchers, CREW takes a very particular position in this domain of research. By integrating immersive technologies in live performances CREW investigates how

different layers of reality can mingle to an altered experience where it is no longer possible to distinguish the medium from reality. [19] The goal of their latest performances was to create a heightened sense of presence, putting the spectator at the heart of the dramatic experience: (1) By means of a HMD and surround video, the spectator is physically placed *into* a video-captured world wherein he can walk and look around. (2) At the level of content/narration the spectator becomes the protagonist of a dramatic event in a virtual environment. (3) By addressing the overall sensory, the distinction between live and mediated stimuli is blurred, a condition that intensifies the experience and causes an altered sense of presence.

Performing arts enjoy a century-old tradition of exploring 'live' human communication. Today, the theatre scene seems to offer a shelter for exploring and testing new technologies. It is, however, a paradox to see that this new merit usually results from the friction that exists between theatre as 'live' art and (as opposed to) the simulation principle of digital technologies. This consciousness in an era of digital spectacle is the main characteristic of CREW's creations. CREW's technological theatre puts the emphasis on the un-mediated in a surrounding that mediates for all and everything. (Figure 1) In this way the company creates a tension, a field of intriguing contradictions and dilemmas, both in the field of theatre and the field of science. The technology required for the performances, is developed by EDM/HU. Thus, the experimental context of a live-art company collaborating with scientific researchers offers a unique sanctuary where immersive strategies can be tested.

3. Immersive technology: HMD and omni-directional video

The performances of CREW make use of the newest immersive technologies developed by EDM. The research activities of EDM/HU are concentrated in (1) computer graphics, computer animation and virtual environments, (2) human- computer interaction, and (3) multimedia and communication technology. They developed an omni-directional video-system, which allows the spectator a surround video display. Spectators (here called 'immersants') in the performances are equipped with a lightweight orientation tracked HMD, a head mounted miniature camera, plus surround sound headphones. The spectator perceives a slice of the panoramic image corresponding with his view direction.[14]

Figure 1 A user being prepared by the actress on stage

Video streams from the head-mounted cameras, from pre-recorded omni-directional sequences and live from custom designed on-site omni-directional cameras are multiplexed. Subtly timed audio feedback and tactile manipulations by the actors in the same room further enhance and enrich the audience's feeling of immersion. In other words, the reality effect experienced by the immersant results from the intermingling of three levels of immediacy and presence: the real time presence of the actors, prerecorded images and metadata embedded in the overall spatiality and action pattern. Immersants are thus teleported from the "here and now", to the "neither here nor now", to the "here but not now" and to the "now but not here" – perhaps next to, or even into, each others body. Non-participant audiences witness the sessions by watching the guidance of the immersants and cameras, while the immersants point of view is projected on a large video screen.

The exploration of the creative potential of omni-directional video has only recently started. The performances CRASH, U, O_Rex and EUX were theatrical experiments in translating omni-directional video into dramaturgical strategies: they are investigations into how ODV can lead to the creation of interesting new forms of theatre and live performance, by installing a new intimacy, and by mixing real and virtual experiences in novel ways. It offers the possibility to extend the traditional categories of experience.

As a powerful new visual medium, ODV also finds applications in tele-conferencing, in the military, and in the planning and preparation of the production of conventional video or film.

4. EUX setup and narrative

In April 2008 CREW started to develop EUX during a one-month research at La Chartreuse (Centre National des Ecritures du spectacle) in Villeneuve-les-Avignon. Drawing on the gathered knowledge on the use of the immersive technology and the narrative strategies of previous immersive

[14] The development of *full* omnidirectional camera systems can be traced back to 1970, when Rees proposed to use a hyperboloid mirror in front of a normal camera and described a method to map captured images to perspective views. Several other such *catadioptric camera systems* (using a combination of lenses and planar or curved mirrors) have been proposed in the 1990s. Several companies offer such mirrors, which are popular for group videoconferencing applications. However, small mirrors are vulnerable to dirt and scratches. Placing them in a protective glass hull introduces unwanted reflections.[14] [2]

performances the company managed to add a new level of immersion that brings to mind synaesthetic and out-of-body experiences. But before going into that subject, we will first describe the setup and narrative of this particular performance.

Different from a classic theater set-up, the disposition of this event is a one-to-one. The spectator in EUX goes through an individual circuit, becoming thus the protagonist of the story. The performance unwinds through several stages, which immerse the spectator gradually into the dramatic world. In order to tempt the viewer to enter this world, an overwrought narrative was set up, giving content to the experience.

In a first stage – an individual walk through the corridors of the monastery at La Chartreuse in Avignon, France - the immersant is told a story in a rather classic way. Through headphones a voice tells in a first-person perspective a narrative about agnosia, the loss of ability to recognize objects, persons, sounds, shapes, or smells while the specific sense is not defective nor is there any significant memory loss. The voice relates the inability to recognize faces, and describes the several phases of this disease that finally will lead to complete mutism, the inability to speak. By addressing the immersant in a personal, intimate way ("like you, I was ill…") the voice guides the immersant also through the physical spaces of the building, which appeared to be the corridors of the institute where the protagonist as a patient was admitted.

The story, or the content, structures the less narrative experience of the second stage, when entering a virtual world through means of a (orientation tracked) HMD and headphones. The live voice of the first-person (an actor) accompanies the immersant through this mediated environment, installing an intimate relation. The voice (the actor) subtly follows the actions of the immersant, and unfolds the story according to the images that appear according to the direction in which the immersant is looking. (Figure 2)

The succeeding sequences bring the several phases of agnosia into experiences, e.g. the inability to recognize your own body and its attendant confusion, the phenomenon of appropriation of virtual parts of the body etcetera. Through this residence in the virtual space, the immersant understands that he is the next patient in the story that has been told to him before entering this world ("like you, I was ill…"). His relation to the content shifts radically, as he becomes the protagonist of the story. Since the immersant also physically embodies this virtual world, and the system of the omni-directional video allows him to look around at his own discretion, classical ways of cinematographic storytelling as framing, montage and rhythm can't be applied. For it is the immersant who decides on the composition of the image by moving his head and physically responding to the voice, but also (more or less) on the tempo of the event as one doesn't know exactly when and to what direction the immersant will look at. To interact as much as possible to the made choices, the voice (of the actor) closely follows the reactions of the immersant and guides him subtly through the story. The text structures the images in the virtual world.

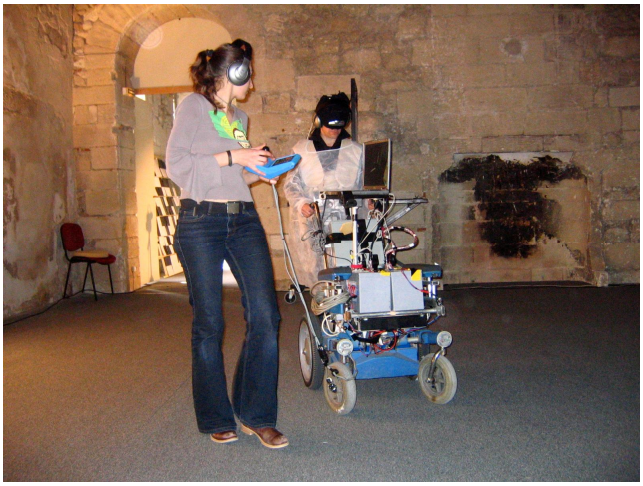

Figure 2 The Immersant navigating within the real / the virtual

In the third stage, the immersant relives the performances, this time from a radical distance. After a final sequence where the immersant meets the successive immersant, he looses his technical equipment (which he symbolically hands over to the next visitor) and is invited to watch the set-up of the performance "from the outside" while his successor experiences the same session "from the inside". He relives the story through the eyes and actions of somebody else, thus forming a synthesis of the immersive experience.

5. Immersive strategies

5.1. Sensorial deprivation

Although art and science have long been dominated by vision, a renewed attention for the overall sensorial system is undoubtedly at stake today, particularly in the realm of new digital technologies and arts.[15] Countering modernist approaches of art and science that divide the senses in separable units, contemporary art and media theory break a lance for embodied experience through senses as a way of thinking and perceiving the world.[16] Sensorial experiences occur in mutual interaction, and art can play an important role in revitalising the overall sensorial and the reflection on embodied technological experience [9]

Studies on immersion and art tend to stress the possibility of being completely in an artificial world, thus making the constitution of presence in mediated environments dependent

[15] Leonardo/International Society for the Arts, Science, and Technology (ISAST) is the leading organization concerning the art-science-technology interaction with remarkable articles and publications on this subject.

[16] The idea of the body as the source of perceiving and knowing the surrounding world is strongly related to the philosophy of perception of the French philosopher Merleau-Ponty (1908-1961). According to Merleau-Ponty every person is able to have synesthetic perceptions, and he points out how synaesthesia and synesthetic metaphors have a common ground in a unified preconscious perception.[12]

on the ability to weld together the senses of the viewer in a synthetic medium. This implies the exact adaptation of the disposition of the human senses to the immersive imagery. According to Oliver Grau, author of *Virtual Art – From Illusion to Immersion*, 'the technological goal, as stated by nearly all researchers of presence, is to give the viewer the strongest impression possible of being at the location where the images are'. Thus, the quality of being present in the images is achieved through maximization of realism.[7]

We would like to make out a case for an additional strategy. The intentional disordering of the sensorial system seems to be even more effective. This strategy does not entirely rely on illusionism, but, on the contrary, deliberately and continuously disrupts a unilateral adaptation to the image. Bringing the immersant in a state of sensorial deprivation disconnects him from reality, dissociating him from common sensorial references. The confusion increases the sensory awareness of the user and consequently gives rise to a heightened degree of presence, a state that corresponds to what we term 'synaesthetic negotiation'.

To achieve a state of sensorial deprivation, the spectator in the performance is physically brought out of balance by means of a tilting bed, submerging him in complete black. The darkness leaves the immersant without any spatial references, which increases the all-over sensitivity. The slow motion of the tilting bed brings the immersant in an appropriate drowsy and absorbed mood.

> Lying on the bed, the visitor is equipped with a HMD through which he perceives an image of the ceiling. After this state of sensorial deprivation this perception is mediated, but as it gives back visual references, it is the only referential handhold for the immersant to construct his 'new' environment. The several sensorial stimuli (live and mediated) are reconfigured, but after this state of sensorial confusion, the immersant has no other choice than to take this mediated information for "true" and present.

When the image slightly turns over, this movement is also simulated by an actor who gently turns and shakes the bed in order to install a subtle correspondence between the image-space seen through the video-goggles and the bodily-experienced environment. This stimulates an embodied perception of a video-captured environment. The natural senses are extended and isolated at the same time. But in reconfiguring the different sensorial stimuli, the performance creates a new realm, a transitional space, where the recorded images mingle with the live tactile and aural sensations. The correlation between different sensorial stimuli, meaning the coherence between for example the mediated image seen through the goggles and the live tactile sensations and/or the sound is introduced as an immersive strategy to blur the boundaries between live and mediated and creating thus a strong feeling of being physically present in this mixed reality.

5.2. Synaesthetic negotiation

The interrelation of the different senses is commonly associated with synaesthesia. Considered as a neurological anomaly of the senses or a universal psychological phenomenon, synaesthesia has intrigued artists, psychologists and other scientists to explore in order to reveal how the senses are interrelated.[17] Notably in the creation and theory of arts it has become an essential feature.[18] Synaesthesia literally means *co-sensation* and it refers to a sensory experience that connects one sensorial impulse to one or more (emotionally) related sensorial qualities. Social scientist Crétien Van Campen considers synaesthesia to be a specific form of what we are all capable of performing, namely "synchronestesia", the simultaneous perception of various signs that address each a different sense [18] Grounded on the philosophical history of the senses, the author defends the existence of a "hidden sense", which is our ability to process information in a unified and more holistic way that lays behind or beyond the processing of information through separate senses.

We propose *synaesthetic negotiation* as a discursive concept to describe our tendency to unify the layered experience to a meaningful and coherent occurrence. Although the senses are isolated and extended in the performance, spectators seem to be capable to unite the separate but simultaneous sensorial stimuli in a coherent and meaningful experience. Moreover, we seem to have the tendency to adjust a small incongruence in the perceived stimuli. Relating these different impressions, sensorial stimuli and signs, one seems to integrate the different sensations in a seemingly coherent whole. In matching what we feel to what we see, the borders between different levels of reality are blurred. The immersant straddles between different medial worlds, which he experiences as one transitional world, in between different realities. Some sequences of EUX can illustrate this clearly:

In the second stage of the performance, the immersant perceives a video-captured image of the same environment where he walked trough shortly before, the corridors of the institute. This omni-directional image-space (which allows the viewer to look around at one's own discretion) is now populated with weird creatures, wearing the same equipment as the immersant himself. The simultaneous sensation of different

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[17] In his article "What is synaesthesia: Myths and Reality" Bulat M. Galeyev, a Russian specialist in synaesthesia, demystifies the Western neurologic approach of the subject, defending the opinion that it's not a mind anomaly but a norm of human psychics. He considers it to be a specific manifestation of non-verbal thinking based on emotional similarity. Galeyev B. M. (1999), "What is synaesthesia: Myths and Reality" in *Leonardo Electronic Almanac*, v.7, N6.

[18] In his study *The Hidden Sense: Synaesthesia in Art and Science* (Cambridge: MIT press, 2008) Crétien van Campen offers a comprehensive overview of the differentiated approaches of the phenomenon. A survey of over four hundred books articles, and Web links on synaesthesia and art, compiled by Crétien Van Campen is available at the Leonardo Bibliography: Synaesthesia in Science and Art Web site, http://lbs.mit.edu/isast/spec.projects/synaesthesiabib.html approaches of the phenomenon

levels of reality, which are the real time presence of the actors intermingled with prerecorded images and tactile and aural metadata brings the immersant in an environment inbetween, where these levels telescope. For instance, the (prerecorded) image of a creature bumping into the immersant, is made physical by an actor, who performs a simultaneous clash. (Figure 3)

Figure 3 Immersant walking through video-captured environment

5.3. Transitional space

As mentioned above, we would no longer describe the embodied environment in terms of virtual as opposed to real, but as a transitional space in between different levels of perceived reality. By intermingling these different sensorial stimuli (live, prerecorded and mediated) the senses are played off against each other, in a perpetual negotiation about the experienced environment. We would argue that presence, or the feeling of being there, is enhanced in particular during this transitional moments, where one has to redefine his world based on the sensorial information. It is in this shifting moment between the embodied and the perceived world, on the fracture between what we see and what we feel that the spectator has the strongest feeling of being there in an immersive experience. In this transitional experience, the perception of the own body is pushed to the extreme, causing a most confusing corporal awareness. An example:

In one of the sequences the immersant sees the image of hands, captured as if it where his own hands. (Figure)These hands are manipulated (touched) in the same way as he feels his own hands being touched (by an actor). This correlation between the perceived image and the tactile sensation can cause a feeling of ownership of the virtual hand in the depicted world, although a friction between these two perceived realities is undoubtedly extant. This phenomenon is known as “the rubber-hand illusion” and has been extensively investigated by cognitive neurologists. In this scientific experiment the sight of brushing of a rubber hand at the same time as brushing of the person’s own hidden hand has proved to be sufficient to produce a feeling of ownership of the fake hand.[4] Under such conditions of multi-sensory conflict, vision typically dominates over proprioception and touch.[11] In other words, the friction between simultaneous sensorial stimuli is cognitive unified in a coherent experience where the dominance of vision causes the feeling that the virtual hand is owned by the person involved. Thus, it is in the perpetual negotiation between what is seen and what is felt that the immersant has a confusing experience, increasing the corporal awareness of presence in a transitional environment.

These correlations can even cause an out-of-body-experience, or a disturbed perception of the own body. Recent neurological experiments have extrapolated the rubber-hand effect to an experiment that uses conflicting visual-somato-sensory input in virtual reality to disrupt the spatial unity between the self and the body [10] As this experiment had a strikingly similar set-up as the performances of CREW, their findings are consequently related: healthy participants experienced a virtual body as if it where their own and localized their “selves” outside of their body borders at a different position in space. These experiments illustrate how the mixture of different levels of reality is strongly related to our tendency to relate the different sensorial data to a meaningful image-world.

Figure 4 Prerecorded image seen by immersant while he is stimulated to copy the movements mirror-wise

Another sequence brings this friction between different levels of reality to an interesting culmination point: in “the writing-scene” the immersant is stimulated to copy the movements of a perceived hand. This hand is captured as if it was his own hand, writing on an opposite body image. At the same time, the immersant’s hand is lead to copy this movement on his own body. While doing so, the immersant very quickly adapts to the rhythm of the movement, as if he feels the urge to coincide with the perceived body. We would explain this in terms of the described synaesthetic negotiation, the urge of the

spectator to 'suspend disbelief' and to hypercorrect the friction between the depicted reality and the tactile reality seems to implicate a negotiation in order to connect the seemingly contradictory information into a coherent experience.

This process of embodiment engenders a multi-layered, processual notion of presence. This notion corresponds to the contemporary epistemology of the virtual self. In *Remediation: Understanding New Media*, Bolter & Grusin more specifically propose a definition of self that 'expresses the tension between regarding a visual space as mediated and as a "real" space that lies beyond mediation'[3] . This double logic of hypermediacy governs all media. The promise of transparent, perceptual immediacy is at the same time balanced by a self-conscious awareness of the medium as a medium. Exactly this tension - the negotiation between the real and the frame, between 'looking through' and 'looking at' – enhances 'our sense of being there'.

Conclusions

We perceive the world with all our senses. In this paper we argued that the sense of presence in a mediated environment is highly related to the recombination of different sensorial stimuli. This was illustrated by describing some of the core sequences in the performances of CREW.

The immersant is put into a state of sensorial deprivation, dissociating him from spatial references. The isolation and extension of the senses trigger our inclination to unite the different sensorial stimuli in a coherent and meaningful occurrence. This process is what we call presence.

In other words, presence is to be located in a transitional space, where the spectator is coming to his senses in a process of continuous negotiation. Presence is never fully there, but always already pending.

Ongoing and future work

Recently, CREW has been involved in **20203D MEDIA**, a large-scale European project (IP) that in March 2008 started the research and development of a new immersive medium. The main focus is on the production of new creative forms of interactive, immersive and very high quality media (such as 3D, virtual and augmented reality) as well as new forms of experiences for individual users based on omni-directional or surround video. This European Research Consortium consists of 16 participating organizations, among them academic research institutes, such as the Heinrich Herz institute in Berlin, CREW's partner EDM/HU (the Expertise Centres for Digital Media at the University of Hasselt, Belgium) and some of Europe's most prominent manufacturers of digital film cameras, projectors, recording and playback systems, post-production and audio equipment and programmers, together with media production and media distribution companies.

As an artistic company in a consortium of industrial and academic partners, CREW is in charge of the realization of the empirical research into aspects of presence, narrativity and spectatorship in film-based 3D immersive environments, a domain in which this collective has acquired a unique expertise through the creation of their immersive performances.

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