

COGNITIVE IMMERSION

Elena Parra and Raquel Navarro.

Researcher of the group of user interaction

Barcelona Media - Centre d'Innovació

Av. Diagonal 177, planta 9, 08018 BARCELONA

Phone +34 93 238 1400 Fax +34 93 309 3188

1. Introduction

The goal of this abstract is to present our research about the cognitive processes involved in 3D immersion and present our research plans about how this type of environment should be helpful for people with special needs, in particular people with cerebral paralysis. First, we will briefly describe the literature in several related areas from which we have started to understand the variables involved in the sense of presence. Then, we present the focus of our current research and a preliminary study that we did in order to explore the cognitive processes related to the transition point when a person believe to be immerse in a "real world". From our preliminary study we gather information about the variables to measure in our next experiment. Finally, we will present how the results of our experiment would be applied in the future to people with cerebral paralysis.

According to previous research, many aspects of the whole 3D experience are implicated in the sensation of presence. In order to understand this, we have reviewed and organised research according to several categories. First, some variables are related to **personal characteristics** of the viewer (such as previous knowledge "as much of contexts 3D as of the content" (2), preferences, emotional motivation and mood. Second, different **characteristics of the 3D environment** have been investigated (3, 4, 5, 6) in relation to their impact on the feeling of presence (Viewpoint of the camera, approaches, music)

In addition, the **characteristics of the surroundings** (External noise.) would be of great relevance for some dependent variables like memory or attention (7, 8). After our literature search, and in spite of much effort to organise the knowledge we have about presence (International Society for Presence Research (ISPR), we have not found a unifying theoretical frame that would organize the results and would allow us to explain and predict when and why the sensation of presence occurs.

No existing framework explains the relationship and interactions among the three types of variables described above.

However, in the 2D context we found that the same types of variables have the same effects on the sensation of presence (<http://scout.ugr.es/>). In our future research, we will work with these variables both in 2D and 3D investigates their effect of on users.

2. First Data Gathering with end user

The focus of our research is trying to understand the precise moment of transition between real conscience (living a real moment) and virtual conscience (the sensation that the virtual context is not virtual but real). In order to achieve this goal we need to know which specific changes occur in this moment of transition (this transition is what we call cognitive immersion).

This research is carried out as part of the project, 2020 3D, funded by the EC, whose goal is to develop new technologies to support the acquisition, encoding, editing, distribution network, and the presentation of audiovisual content stereoscopic immersive, to make it possible to provide new forms of cinema. A significant part of this project is devoted to understanding the psychological and social aspects related to users perception and reaction to 3D content. Within this project we have collaborated with CREW (a Belgium-based performance group, it has insisted on making performances at the melting point of live art and technology <http://www.crewonline.org/crew.html>) in order to investigate 3D immersive environments, specifically in a performance where all the sensory levels of information (visual, auditory and touch) was presented. We interviewed 9 viewers of this performance, to gather evidence about the most important factors that would explain the feeling of presence - when and how it happens. These factors were explored by asking viewers specific questions that measured memory, attention, background and immersion.

Examples of questions are:

Did your sensation change when you saw yourself?

Which part of the session gave you the strongest *feeling* of being inside the world of the story? Where did you feel the most involved? Which moments do you *remember* the most?

Did you ever have a similar experience?

In this study we found that the moment of change in sensory inputs produced high attention, and this attention correlates with the moments that provoked a strong memory. In addition, these specific sensory changes where the moments that were reported as a more intense sense presence from the viewers.

In summary, from the results of these interviews we found evidence for the claim that **attention and consequently memory, are very key in the transition between reality** (understood as the real surroundings of the subject) **to**

virtual reality (understood as the realistic interpretation of the information perceived in virtual surroundings). Therefore, understand the changes of focus in attention is very important for what we understand as cognitive immersion.

3. Next steps

We are preparing an experiment that would allow more detailed study of the cognitive process of attention in relation to cognitive immersion. In particular we are interested in the precise moment where the changes in attention impact the sense of presence and how that helps memory. Some examples of situations that would trigger changes in attention are when we present different sensorial inputs (Effect von Restorff, Parker, Wilding and Akerman, 1998¹).

We will present the users with different degrees of virtual reality from 2D and 3D, with different levels of emotional content, according to the preferences and motivations of the users. In this content we will control of sensory changes in the context. We will measure their changes in attention through eyetracking. We will also measure memory, and a posteriori give a questionnaire about presence to understand both of the variables and how they are implicated in the moment of the change (cognitive immersion). In addition, we will also manipulate some of the variables described in the brief literature review. In particular we will like to see the effect of personal preferences about emotional content and some characteristics of the 3D environment.

Our findings will broaden the understanding of the mental processes involved, in particular to attention. We will consider previous literature about the parts of the brain involved in attention, and problems which disabled people have. After this experiment, if we confirm our hypothesis about the effect of attention, we will explore the usage of our knowledge about cognitive immersion with users who do not have injuries in the frontal, prefrontal and parietal crust (the areas most important in attention), as in the case of cerebral paralysis. These users have great limitations of movement, but they are able to learn and to focus their attention on stimuli of the context. For that reason placing these subjects within a virtual context could be very effective. They are able to control and to modify the situations without large movements (increasing independence and quality of life.) Other possible applications for our findings are to use these changes of sense for stimulation and improvement of the development in children with this disability. Our claim is that virtual environment tailor to these type of user would provide an effective source of stimulation that would enhance their learning of abilities. We could create a simulation of the real world where the subject can move and learn about the

context and increase their movement capacity through expanding their mental maps.

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