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Physical Body Awareness and Virtual Embodiment

A Hybrid Experience of Otherness

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Abstract. *Body awareness and embodiment are core terms and research topics being used to comment on the new interdisciplinary aspects of virtual immersive experiences. In this article, we present the methodology adopted in the Disembody research project with the aim to explore body-space relationship through the lenses of interdisciplinary considerations drawn from architecture and cognitive science. Employing an empirical, case study approach inside virtual reality (VR), we came up with observations about how virtual embodiment can be experienced as an instance of otherness embodiment that generates a sensation of alloæsthesia. This post-human condition can be bi-directionally fed into re-establishing the body-space relationship towards expanded architectural and cognitive perspectives.*

Keywords. *Body awareness, Virtual Embodiment, Space Perception, Expendable Bodies*

Introduction

This article provides an overview of the methodology and the orchestration of the empirical research conducted under the project *Disembody: Augmented corporeal experiences in the hyper-tectonic environment of a digital platform*³. *Disembody* explores diachronically dominant architectural research questions concerning aspects of the body-space relationship through the lenses of the latest interdisciplinary considerations of cognitive sciences and architecture. Architecture and contemporary neuroscience research present similarities in the way they deem the human mind and body, as they are both founded upon human corporeal experiences and the innate nature of humans' biologically grounded perception, either conscious or unconscious. Indicatively, the awareness of the complexity of cognitive and emotional processes involved in the daily experience of designed environments has rapidly grown with implications for a *sensory intensification* in architectural design (Van Kreij, 2008).

The project's objective is two-fold: (a) to analyse corporeal necessities-conditions, considering them as psychosocial and psychosomatic patterns, either material, anatomical or biochemical, making use of both qualitative and quantitative metrics (e.g., pre- and post-questionnaires and motion capture of users' body experiences in virtual

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reality (VR) environments), (b) to implement the findings of the empirical research towards the design of an experimental VR platform.

The Background: Physical Body Awareness and Virtual Embodiment

The notions of ‘embodiment’, ‘body awareness’, ‘body-space’ and ‘proprioception’ explored and mapped by neuroscience (De Vignemont et al., 2005) have provided a scientific breakthrough that has inspired research in the fields of architecture, planning and urban studies, and architectural thinking (Papale et al., 2016). The architectural design can be approached with a neuroscientific perspective on perception and aesthetics (Albright, 2015), as the role of embodied cognition through the mirror neuron system is connected with aesthetic responses through sensory perceptions. Thus, embodiment is considered the main body’s ability to spread and appropriate the environment, as an internal habitation mode for perceiving the complexities of the world. In space perception procedures it is not only the vision that adapts a semiotic operation of recognition, but the whole body which participates in the process; it is a kinetic expression of the spatial sensation, a multi-sensorial participation, a combination of a body-impulse and a movement technique. Consequently, space does not constitute an *a priori* experience, a separate objectual phenomenon; rather it is a component of the embodied experience that arises in the over neuro-sensitive procedure, which means that other multisensorial stimuli intervene in this process as well.

In contemporary context, new emerged atmospheres offer an approximation to this expansion of the spatial experience, as the sense of immersion is increased when the body is mirrored or duplicated by avatars (Fels, 2000); thus the VR environment presents even more multiplied characteristics and experiences than the physical one. Virtual embodiment, then, seems to invite the physical body to embody ‘another’ identity and sensoriality. The embodied cognition evolves from an initial grounded perception to a hybrid unstable experience of otherness as the avatar’s ‘mereology’ forces a double sense of “being really in place.” These embodied conditions present further interpretations for the notions of the ‘egocentric’, ‘allocentric’ (Ekstrom et al., 2014) and ‘peripersonal’ space articulations in interaction realities with the ‘otherness’ as a newly emerged entity (Roncone et al., 2016).

Interaction engagement in VR is closely related to full-body ‘extended’ experience and it is perceived as threefold: (a) as the feeling of presence in the digital environment - fantasy; (b) as affective aspects of human-human interaction - communication; and (c) as regulatory properties of emotion - affect (Bianchi-Berthouze et al., 2007). Thus, the virtual ambiances activate the ‘incorporative memory’, a function of embodied learning processes (Panhofer, 2017), since the body is connected with the highly incorporative capacity of new postures, gestures and movements leading to an internal constitution of hybrid identities, in constant movement and diversity. According to our perspective, these experiences are the new contexts that comprise the current ‘post-human’ condition; the ‘de-/multi-subjectivity can be bi-directionally’ fed through the embodied interactions in virtual reality worlds into re-establishing the traditional relation of body and space towards a new expanded architectural context with embodied cognitive perspectives.

The Hybrid Otherness in Motion: the Methodological Path

The research under *Disembody* aims to shed light on the exploration of the ‘expansion’ of human corporeity in architectural practice. To accomplish this the project is structured into three main stages:

1. Compiling an extended list of bibliographic references, an archive populated with theoretical and experimental accounts of human body-space interaction selected from the relevant inter-disciplinary literature;
2. Conducting an empirical research with 25 participants, students of architecture at the University of Thessaly. A mixed type of instruments have been used, such as a pre- and a post-questionnaire and a motion capture recording session during which the participants have been engaged with four different video games in VR environments.

By analysing the pre-questionnaires, we came up with different profiles based on notions discussed in the literature of philosophical phenomenology (Colombetti, 2011). Participants' profiles were marked as 'high-, mid- and low-level of experience' according to their previous experience with VR. Having been evaluated for their physical activity and the level of their bodily self-awareness, two main profiles were further recognised: (a) those showing 'reflective self-awareness', corresponding to physical activity conditions where their body comes to the foreground of awareness; (b) those with 'non-reflective self-awareness', where in the same physical conditions their body remains at the background of consciousness. In Legrand's terms (2007), 'reflective bodily self-awareness' is a thematic, observational consciousness of one's own body as an object whereas 'reflective bodily self-awareness' is an unmediated, nonthematic way of being aware of one's bodily self.

The post-questionnaires, filled in after the participants' engagement with VR, were based on the standardized embodiment questionnaire proposed by Gonzalez-Franco and Peck (2018), which were extended to explore and measure, apart from the 'level of avatar embodiment', whether the participants had experienced 'a reflective or a pre-reflective bodily awareness', 'the level of the space embodied perception' (high, medium, low), and 'their self-evaluated level of immersion' inside VR (high, medium, low).

By using correlation analysis as a statistical method to evaluate the strength of the relationship between the variables related to the participants' profiles in the pre-questionnaire (i.e. previous experience with VR and *reflective* and *pre-reflective* bodily awareness in physical space) and those related to the post-questionnaire, we concluded with the following findings:

- There is a strong relationship between the reflective bodily awareness of the participants in the physical space and that experienced inside the VR;
- The more the reflective bodily awareness shown by the participants in the physical space the higher is the level of the space embodied perception inside the VR;
- There is a strong relationship between the reflective bodily awareness of the participants inside the VR with the degree of their enjoyment and freedom they experience therein.

Apart from the analysis of the questionnaires, the empirical stage of the project provided an additional methodological procedure for the exploration of body-space relation, focusing on four case studies-applications, by means of a head mounted device. The selected applications - Blocks by Google⁴, Freedom Locomotion VR⁵, Kinese⁶, Wave

4. See: https://store.steampowered.com/app/533970/Blocks_by_Google/

5. See: https://store.steampowered.com/app/584170/Freedom_Locomotion_VR/

6. See: <https://store.steampowered.com/app/632080/Kinese/>

Beta⁷ - present imposed or allowed privilege of movement at different degrees, diverse types of natural or artificial interaction with the environment, fluctuations in complexity of geometrical representations and diversified narrative contexts. Thus, through contrasting different engagement interactive scenarios experienced by the participants, a varied body-movement patterns were revealed for each participant and for each case study (Figure 1).



Figure 1. Empirical stage documentation process of *Disembody* project.

The findings interrelating the questionnaires analysis with the motion capture data confirm that:

- There is a strong relationship between embodied interactions with other virtual entities and the overall body awareness;
 - There are serious indications that virtual embodiment can be related to a better practice of embodying another state of subjectivity, that is embodying an ‘alloæsthetic’ state.
3. At the final stage, a digital reference platform, called DISEMBODY, an expendable bodyscape, will be developed comprising: (a) methodologies about understanding, registering and categorizing corporeal data in body-space interactions; and (b) a pilot interactive application adaptable within real-time performance conditions in VR. The temporal body-space compounds are called *expendable meta-bodies*, as the digital space interacts along with body’s movement, enhancing and intensifying the body awareness and aiming to assign a kind of virtual embodiment to the space itself (Figure 2).

7. See: https://store.steampowered.com/app/453000/Wave_Beta/

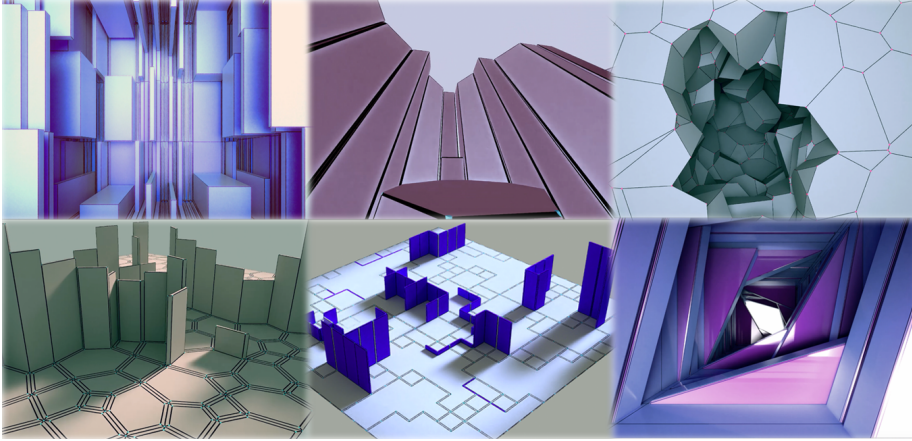


Figure 2. Interactive application images from the animation video demos.

Conclusions

The innovation of the research project lies in applying theoretical, empirical and design procedures in order to associate architectural practices with embodied inter-related environments. We have initiated the exploration of ‘materiality’, ‘de-subjectivity’ and ‘corporeity’ through the bibliographical and empirical research stage. The questionnaires and the main thematic fields have been structured in order to identify the wide range of implications and correlations between the body and the space. The motion capture techniques and the audiovisual documentation provide the context of multimodal data flow that have been used to extrapolate the conclusions of the overall research.

In this vein of performative technology, the bodies are the ultimate mediators and the question of the limit is repeatedly evidenced through corporeity, since bodies have been expanded in time, space and consciousness. Traditional concepts such as otherness and sameness are questioned and our ‘expendable meta-bodies’ inscribed in the assimilation of the partiality, intimacy and proximity, aim to produce and redefine the ‘alloaesthetic’ sensation.

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