Brain Activity Underlying Third person and First person Perspective Training in Virtual Environments

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1. Introduction

Over the years, different approaches have been explored to build effective learning methods in virtual reality but the design of effective 3D manipulation techniques still remains an important research problem. To this end, it is important to quantify behavioral and brain mechanisms underlying the geometrical mappings of the body with the environment and external objects, both within the virtual environments (VE), the real world and relative to each other. The successful mapping of such interactions entails the study of fundamental components of these interactions, such as the origin of the visuo-spatial perspective (1PP, 3PP) and how they contribute to the user's performance in the virtual environments. Here, we report data using a novel set-up exposing participants - during free navigation - with a scene view from either 3PP or the habitual first-person perspective (1PP).

2. Methods

We asked 16 participants immediately after 1PP or 3PP exposure to judge the interception of a ball projected on the HMD at different trajectories (20cm, 60cm, &150cm) from a fixed origin. The device consisted of a rigid backpack, a camera and a head mounted device (HMD) to which the video captured from the camera was relayed in real time [Salamin et al. 2006]. Brain activity was measured through continuous electroencephalogram (EEG) and was recorded from 16 electrodes on the scalp.

3. Results

Analysis of the evoked potential (EP) mapping of the group averaged data from the 16 participants revealed the presence of two distinct brain activities between ~120ms to ~155ms and ~470ms to ~530ms post stimulus onset, whose duration (in ms) and strength (in μV) in the 3pp condition were significantly longer and stronger as compared to the 1pp purely for the ambiguous stimulus trajectory (60cm). These data reveal a functional modulation of the grasping space based on perspective training (3PP, 1PP) during the free walking, unrelated to the task and suggest that despite better distance and overview estimation in the 3PP condition, here the participants intercept the ball more often post 1PP training for the ambiguous trajectory.

4. Discussion

The data gives us an insight into the mappings that are permissible and shows that exposure for as less as 15 minutes to a different perspective can degrade or enhance performance in different scenarios. In future studies, it will be important to look at effective usage of the perspectives for optimal learning methods in social interactions in virtual environments.

Through my doctoral work, I study the functional and neural mechanisms underlying corporeal awareness and self-consciousness in humans using virtual reality in conjunction with neuroimaging techniques. This allows us to do multidisciplinary work combining cognitive psychology, neuroimaging, and VR. The current study gives us an insight into the malleability of the origin of the visuo-spatial perspectives as human interaction with the environment is a multi-modal process and VR can generate realistic scenarios where the user has an egocentric position similar to the real world. VR can be used to distort and modulate this egocentric position as well as ownership of the body and self location.

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