

Effects of a Head Mounted Display Adaptation on Reaching Behaviour: Implications for a Therapeutic Approach in Unilateral Neglect

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Abstract : Background: Unilateral spatial neglect (USN) is a common syndrome following damage to one hemisphere of the brain (usually the right side), in which a patient fails to report or respond to stimulation from the contralesional side. These symptoms are not due to primary sensory or motor deficits, but instead, reflect an inability to process input from that side of their environment. Prism adaptation (PA) is a therapeutic treatment for USN, wherein a patient's visual field is artificially shifted laterally, resulting in a sensory-motor adaptation. However, patients with USN also tend to perceive a left-leaning subjective vertical in the frontal plane. The traditional PA cannot be used to correct a tilt in the subjective vertical, because a prism can only polarize, not twist, the surroundings. However, this can be accomplished using a head mounted display (HMD) and a web-camera. Therefore, this study investigated whether an HMD system could be used to correct the spatial perception of USN patients in the frontal as well as the horizontal plane. We recruited healthy subjects in order to collect data for the refinement of USN patient therapy. Methods: Eight healthy subjects sat on a chair wearing a HMD (Oculus rift DK2), with a web-camera (Ovrvision) displaying a 10 degree leftward rotation and a 10 degree counter-clockwise rotation along the frontal plane. Subjects attempted to point a finger at one of four targets, assigned randomly, a total of 48 times. Before and after the intervention, each subject's body-centre judgment (BCJ) was tested by asking them to point a finger at a touch panel straight in front of their xiphisternum, 10 times sight unseen. Results: Intervention caused the location pointed to during the BCJ to shift 35 ± 17 mm (Ave \pm SD) leftward in the horizontal plane, and 46 ± 29 mm downward in the frontal plane. The results in both planes were significant by paired-t-test ($p < .01$). Conclusions: The results in the horizontal plane are consistent with those observed following PA. Furthermore, the HMD and web-camera were able to elicit 3D effects, including in both the horizontal and frontal planes. Future work will focus on applying this method to patients with and without USN, and investigating whether subject posture is also affected by the HMD system.

Keywords : head mounted display, posture, prism adaptation, unilateral spatial neglect

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