Voluntary Hand Movements Discipline Audiovisual Perception

Ahmad Yousef¹

¹School of Computational Science and Engineering, McMaster University, Hamilton, Ontario, Canada

*Correspondence: mohamas2@mcmaster.ca

Abstract—We had shown that deep breathing had been able to effectively and timely alter visual and auditory bistable perception, see reference 1, 2. Deep breathing requires cognitive control, and therefore, in this study, we decide to investigate whether voluntary movements of human hands are able to govern the audiovisual perception using an integrative stimulus that's built up with the aforementioned visual and auditory stimuli. Astoundingly, when the human subjects moves a pointer (hand) in harmony with the actual physical direction; the original materials of the audiovisual stimulus appear. Reversed perception, namely, illusory motion reversals and illusory word appear when the pointer is moved in the opposite direction of the actual motion. Cognitive actions' brain areas, namely, dorsolateral prefrontal cortex, premotor cortex, and primary motor cortex may require high concentration of oxygenated hemoglobin in the red blood cells to achieve fulsome executive movements; and this could results in significant reduction of the concentrations of the oxygenated hemoglobin in the red blood cells in the visual and auditory cortices. Reductions that deactivate one of two; the central versus the peripheral conscious brains (dedicated for audiovisual perceptions); deactivation that causes stoppage against bistable audiovisual perception will occur. We thus hypothesis that the DLPFC may send signals to deactivate the peripheral areas in the sensory brain regions when the cognitive action is harmonized with the actual material; but it may send a contrary signal to deactivate the central areas in the sensory brain regions when the cognitive action and the actual material are disharmonized.

Introduction

The dorsolateral prefrontal cortex (DLPFC) has important role in the executive functions, see reference 3. It's the highest cortical area which is responsible for motor planning, organization and regulation, see reference 4. It's not only responsible for decision making but for motor signaling, see reference 5; and it's neurologically connected to the premotor cortex. Cognitive action is therefore a sophisticated neurological task; it starts from the prefrontal cortex until towards the primary motor cortex, through the premotor cortex and supplementary motor area; eventually the motor signal will be carried over several neurons to trigger voluntary movements. Important to mention, the prefrontal cortex and the primary visual & auditory cortices are spatially located away from each other; we therefore hypothesize that voluntary movements by hand may alter the human audiovisual perception. To test this hypothesis, we built

integrative bistable audiovisual stimuli that's randomly trigger two different audiovisual perceptions, see reference 6. All of the human subjects, however, had noticed that the voluntary hand directive movement had great influence in the audiovisual perception. In another word, when they approachably run a pen over the stimulus, see the central figure, they see/hear the actual material if the direction of the pen is similar to the actual physical direction; and if the direction of pen is opposite, the subjects hear/see illusory materials.

Materials & Methods

Twelve human subjects with dilated pupils were recruited to participate in this study. The experiment had been achieved with a non-touch screen with refresh rate of 60Hz. The experiment have to be tested with certain parameters & to be counterbalanced; each of the aforementioned cases have to be tested for three time aiming for fine tuning, see reference 6. Each trial has "no voluntary movements" session in the beginning to allow the subject to understand the meaning of illusory motion reversals & verbal

transformation, namely, to make sure that the subject is able see & hear the audiovisual rivalry (monocular motion bistable perceptual rivalry and verbal

transformation). Subjects who don't see/hear the rivalry are temporarily excluded and are advised to take necessary actions for pupil dilation. The stimulus subtends 12.9 DVA length and 1.37 DVA width and consisted of 8 cycles and runs at constant speed of 12.9 DVA/sec. Verbal transformation auditory stimulus, see reference 2, had been integrated with the above-mentioned visual stimulus in a synchronized way. Human subjects are requested to change the movements of the pen over the stimulus randomly to confirm the effect. The stimulus had been flipped to for counterbalancing purposes. The stimulus has two conditions mute versus unmute to verify that the visual stimulus can produce similar visual awareness produced by the audiovisual stimulus. Astoundingly, the human subjects had been visually & auditorily aware about the actual visual motion direction, and the word 'life' when they move pen in the actual physical direction; but all of them had seen illusory motion reversals, and hear the word 'fly', when they move pen in the opposite direction of the actual physical motion. Noticeably, all of the human subjects had noticed that whether the auditory stimulus is presented, the visual stimulus produces unchangeable visual perception. The confidence level in reporting the aforementioned effect was ultimately satisfied in the motion visual perception for both condition

(mute/unmute), but there are kind of statistics for the auditory perception as we will show in the next section.

Data Collection & Methodological Analyses

The behavioral data were collected manually for two different categories (the pen is moved with the actual physical motion versus against the actual physical motion). Whether the case is normal or counterbalancing; all of the collected data are averaged for each human

subject to create mean values. These mean values 'twelve' mean values afterwards are used to estimate the mean value, and standard error of the mean. To comply to the declaration of Helsinki, however, we confirmed comfortable settings for each subject.

Results & Discussion

We had previously discussed with psychophysical settings that humans could have two distinct areas in every region in the brain; and we have deep investigations to prove this claim in the human medial temporal complex, the auditory cortex, and the fusiform face area, see reference 7, 8, and 9. We now hypothesize that there might be an area in the prefrontal cortex, possibly DLPFC, that's able to activate the central versus the peripheral regions of certain intended areas. Namely, the DLPFC seems to signal the visual and the auditory cortices requesting for deactivating the peripheral hMT+ and the auditory cortex area when the cognition action is in harmony with the actual materials. Harmonies that might have been unstoppably exerted by professional players like Lionel Messi, see reference 10. In contrary, the DLPFC may send signals to activate their peripheral sensory regions, and inactive their central regions when the cognition action and the actual material are disharmonized. Noticeably, the prefrontal cortex and the perceptual cortex are spatially away from each other, namely, there is a possibility that when the prefrontal cortex requests for increasing the oxygenated hemoglobin in the red blood cells, forcible reduction of these cells might be occurred in the perceptual cortices.

Essential Notifications

Readers should have direct access to the stimuli, see reference 6. Advisably, download the videos for the best quality. Be sure that you have dilated pupils before the experiments, if you don't see illusory motion reversals in the first session (no voluntary movement), then you're still not ready. In order to dilate the pupil, watch the video in fifty percent brightness, and have some caffeine intake, see reference 11. During the experiment kindly do significant approach to the computer's screen with the element without touching the screen, if not possible, use elements that will not scratch your monitor, such as pen, stick, or even your finger.

Importantly to mention, scholars with MRI, EEG, MEG, ECG, & professional eye-tracker facilities are welcome to collaborate in challenging investigations, namely, to see what all of these facilities can tell us about the current experiment. Scholars who wish to acquire high temporal resolution neurophysiological signals from different nodes in PFC region to distinguish between the

sending signals to the perceptual cortices through the present experiments are extremely welcome. Enquiries may be sent to the author. Important to mention, scientists had recently reported that there is Intraindividual consistency between visual and auditory multistable perception, see reference 12; the aforementioned fact may explain why the auditory perception had been easily integrated with the visual perception, namely, the actual physical material of the audiovisual stimulus appears together, and the illusory ones also appears together. Interesting to mention, based on our primarily observations, circular 'drawing' clockwise & anti-clockwise outstandingly governs 'rivalrous circular apparent motion perception'; observations that ultimately defend the claim of the current research. In the end, we had to confirm here that harmonized versus disharmonized voluntary movements had shown outstanding abilities not only in altering audiovisual perception, but in sufficiently controlling the perceptual rivalry generated by audiovisual stimuli.

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