The role of eye movements in the ‘Spine Drift” illusion perception

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Studying visual illusions provides researchers with important insights into the rules of brain mechanisms for visual processing. Recently new motion illusions were appeared and striking one was the “Spine Drift” illusion. The illusion display consists of spindly thingies (“spines”) having an orientation differing by 90° for the central and peripheral squares with a gap demarcating a square in the middle. The central square appears to float relative to the peripheral one. It was shown that drift illusions were strongly affected by eye movements (Kitaoka, 2010). Early it was proposed the role of macro eye movements in perception of motion illusions: eye movements induced retinal motion blur which differed for central and peripheral spines, causing a seeming shift in motion. More recently the impact of micro eye movements was shown for the Enigma illusion (Troncoso et al., 2008). Unfortunately not much is known about the impact of micro eye movement in the “Spine drift” illusion perception. The aim of our study was to reveal the role of macro and micro eye movements in the “Spine drift” illusion perception. The original display of the illusion was changed to construct four modified variants: for the first three variants the orientation of each spine of the central square was shifted by 30°, 60°, 90° respectively; for the fourth variant all spines of the central square were oriented in random order. Twenty four observers (15F, 9M, age range 16-25) were tested. They perceived the illusion display for 10 s and then were asked to estimate the strength of illusory motion on a scale of 1-5. During the performance eye movements were recorded. Microsaccades were determined with the algorithm reported in Engbert and Kliegl (2003). The results showed that the differences in spine orientations of the central and surround squares were the clue cause of illusion perception: the illusion strength was highest for the original display and then reduced gradually with decreasing differences between spine orientations of the central and peripheral squares. For the randomly oriented spines the strength was medium. Differences in fixation durations and microsaccade counts were correlated with subjective ratings. No significant differences for saccade counts were found. Individual parameters of eye movements varied over a wide range when observing the illusion. Our results indicate that micro and macro movements may be considered as reliable indicators of the illusion perception.