Inter-individual differences in motion direction perception: physiological correlates in hMT+

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Abstract

Visual motion direction is processed both in the primary visual cortex (V1) and the human motion complex (hMT+) along the dorsal visual stream. While behavioral studies have revealed inter-individual differences in motion-direction perception, it remains unclear on which processing level these differences are reflected in neurophysiology. Results from animal studies point to the hMT+ as a likely candidate: neurometric functions of MT direction sensitive neurons have been shown to relate to psychometric functions within individual monkeys. In humans, the physiological correlates of inter-individual perceptual differences are still largely unknown. To investigate, we used functional magnetic resonance imaging (fMRI) while participants viewed translational motion in different directions, and we measured thresholds for direction discrimination of moving stimuli in a separate psychophysics experiment. After determining hMT+ in each participant with a functional localizer, we characterized its signal variability during stimulus and rest periods with a generative model. Relating perceptual performance to physiology, individual direction discrimination thresholds were significantly correlated with the variability measure in hMT+, but not V1. Higher levels of fMRI signal variability compared to rest correlated with higher perceptual sensitivity. This is in line with theories on stochastic resonance, which suggest that endogenous or exogenous noise can increase the sensitivity to incoming signals. What remains unclear however is whether the observed variability reflects intrinsic hMT+ properties or top-down signal modulation. As to elucidate this point, we started to address the contribution of cognitive control on hMT+ signal characteristics by means of a conflict task.

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