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Mechanisms of Motion-Defined Shape Perception Elucidated by the Regression Analyses between Psychophysical and Psychophysiological Data

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To elucidate the mechanisms of motion-defined shape perception (SP), we carried out experiments by employing the random-dot kinematogram. Participants were asked 1) whether a coherently moving dot in a core rectangle was moving "toward the upper left or lower right" (direction discrimination task) and 2) whether the shape of a motion-defined rectangular area composed of the moving dots was "oblong vertically or horizontally" (pattern discrimination task) with various moving velocities from 14.4 to 126 deg/s. When stimuli were presented in the upper or lower half of the visual field (VF), the rate of correct responses for six participants were significantly higher in the lower VF than in the upper VF for the pattern discrimination task (lower VF enhancement) at 25 and 40 deg/s ($p<0.05$) but not for the direction discrimination task. When the visual-evoked potential was measured in the psychophysiological experiments with similar stimuli, the amplitudes of the peak potential at 290 ms were significantly correlated with the data of correct-response rates for the pattern discrimination task ($p<0.05$) alone. It was suggested that the information was initially treated for motion itself in the magnocellular system and then returned presumably to the parvocellular system in the primary visual cortex to accomplish the motion-defined SP at approximately 290 ms.

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