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## Presentation Abstract

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Title: Proprioception of the hand contributes to visual recognition speed and accuracy: Evidence from the Multi-Modal Convergence Map model of Parietal Cortex Area 5

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Abstract: During visually guided reaching and grasping, vision and proprioception of the hand are integrated to allow for maximal speed and accuracy of movement. Neurophysiological data indicate that BA5 in the posterior parietal cortex is one region in which information from the visual and proprioceptive modalities converge. In addition to movement accuracy, experimental data have demonstrated that preparation for a grasp will influence visual perception of objects in the context of the grasp. This indicates that proprioception can influence vision. This is consistent with a neuro-robotic model of visual- proprioception interaction that we have recently developed in the context of visually guided motor control.

The Multimodal Convergence Map (MMCM) is a self-organizing map connected bidirectionally to regions encoding visual and proprioceptive information, and thus implements this anatomically supported integration function of BA5. We performed experiments using a robot arm and the Spikenet vision processing system that was used to recognize the hand of the robot arm in different configurations. The task for the system is to recognize its hand as the hand moves through a continuous trajectory of postures. Based on data from the literature, we hypothesized that from the unbounded possibilities that the visual image of the hand could take, proprioception of the hand would significantly reduce those possibilities, and allow the visual system to predict or anticipate the approximate image of the hand. This prediction would allow the system to perform more optimally by restricting and refining the possible models used in the recognition.

Our experiments revealed that when the MMCM model was used, the visual response selections were significantly refined (the receptive properties of the

vision system was constrained to approximately 10% of the total of 112 response possibilities). That is the visual system became selectively tuned to visual images of the hand, corresponding to the current posture of the hand. This resulted in a significant improvement in the speed and accuracy of visual recognition. The model can also be used in the opposite sense, where visual recognition of the hand will predict the postural proprioceptive configuration.

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