PERCEPTION

Human MT+ activation is enhanced by adding color to high luminance motion

Yan Wang*, Fucang Jia*, Jinghui Zhao*, Lin Ma†, Dejun Li†, Xuchu Weng*, Yuejia Luo*, Sheng He‡

**Laboratory for Higher Brain Function, Institute of Psychology, Chinese Academy of Sciences*

†Department of MRI, General Hospital of PLA

‡Department of Psychology, University of Minnesota

Many psychophysical experiments have demonstrated that human motion system is insensitive to chromatic input. FMRI studies also show that MT+ activity is the lowest when the stimuli are at isoluminance. However, single unit recording showed that MT neurons do respond to isoluminant chromatic stimuli, but only when luminance contrast is low. In other words, adding chromatic information to stimulus that already has high luminance contrast does not contribute to the activity of MT neurons. Using event-related fMRI, the goal of the present study is to examine whether chromatic information affects human MT+ activity when the stimuli already have high luminance contrast.

Methods

Nine volunteers with normal acuity and color vision participated in the study. Five T2*-weighted coronal slices covering the occipital cortex were collected with EPI sequence on a GE Signa Horizon MRI scanner (TR: 2 s, TE: 55 ms, thickness/skip: 6/1 mm, slices: 5, in-plane resolution: 2.75×2.75 mm2). On a background of stationary gray dots, one of three stimuli was presented for 2 s every 16 s. The three types of stimuli used were: stationary color dots, moving gray dots, and moving color dots. Functional images were co-registered with high-resolution whole-brain structural images, and were motion-corrected, linearly de-trended, spatially normalized and smoothed with a 4 mm FWHM Guassian filter. Deconvolution and linear multiple regression procedures were used to estimate the hemodynamic response function (HRF) of each voxel and to generate the activation maps for each types of stimuli.

Results and Discussion

In all 9 subjects, not surprisingly, bilateral MT+ areas were significantly activated when moving gray dots were presented. However, activation in MT+ became greater when moving colored dots were presented. The enhancement of MT+ activation was seen both in volume and in signal intensity. Interestingly, stationary color stimulation only elicited activation in the ventral occipitotemporal cortex, not in MT+. These results suggest that color can enhance the response of human MT+ to motion stimulus, although color information by itself has little effect on MT+ activity. The current finding differs from recent single unit recording evidence that suggests chromatic properties contribute little to motion processing in MT when there is sufficient luminance contrast available. It remains to be seen whether this discrepancy reflects inter-species difference or inter-technology difference.