Perceptual learning modifies the functional specializations of visual cortical areas

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Training can improve performance of perceptual tasks. This phenome-

trained stimulus, we uncovered much more profound functional changes in the brain than expected. Before training, V3A and MT+ were the dominant areas for the processing of coherent and noisy motion, respectively. Learning modified their inherent functional specializations, whereby V3A superseded MT+ as the dominant area for the processing of noisy motion after training. This change in functional specialization involving key areas within the cortical motion processing network served as the neural substrate for the transfer of motion perceptual learning.

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P. In our first experiment, we used TMS to identify the causal contributions of V3A and MT+ to coherent and noisy motion processing before

the 100% and 40% coherent stimuli [both $t(9) > 3.14$; $P < 0.05$]. For the MT+ stimulation group (Fig. 3*B*), the main effect of TMS and the interaction were not significant [both $F(1,9) < 3.27$; $P > 0.05$]. These results demonstrated that, after training, TMS of V3A disrupted motion processing not only for the 100% coherent stimulus but also for the 40% coherent stimulus. Surprisingly, TMS of MT+ no longer had any effect on task performance for the 40% coherent stimulus, which was in sharp contrast to the pronounced TMS effect for this stimulus before training.

In the untrained hemifield, for the V3A stimulation group (Fig. 3*C*), the interaction was not significant [$F(1,9) = 0.07$; $P > 0.05$], but the main effect of TMS was significant [$F(1,9) = 13.08$; $P < 0.01$]. After TMS, subjects' discrimination thresholds decreased for the 100% coherent stimulus [$t(9) = 3.58$; $P < 0.01$]. This facilitation might reflect a TMS-induced disinhibition of contralateral cortical activity (17), which will be a topic for future investigation. For the MT+ stimulation group (Fig. 3*D*), the main effect of TMS and the interaction were not significant [both $F(1,9) < 0.77$; $P > 0.05$].

The TMS experiment demonstrated that before training, V3A and MT+

by weighting each voxel's response to maximize the ratio of the between-direction (trained directio

V3A were weighted more heavily than those from any other visual cortical area for both kinds of motion. The popular