

July 14, 2009

Sensory Plasticity and Motor Learning

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ABSTRACT OF THE TALK

Is plasticity in sensory and motor systems linked? In this talk, we will describe recent studies involving both human arm movement and speech motor learning that test the idea that sensory function is modified by motor learning. We will present data that show that dynamics learning is associated with changes to the sensed position of the limb and that speech motor learning affects a speaker's auditory map. In both limb and speech studies, we assessed motor learning by using a robotic device that displaced either the arm or the jaw during movement. In studies of arm movement we obtained estimates of sensed limb position before and after force-field learning, using two different techniques. In one technique, we assessed the sensed position of the limb by having subjects indicate whether a force-channel deflected

movements to the left or the right. A second technique used an inter-limb matching procedure to obtain estimates of the sensed limb position. In speech studies, we presented auditory stimuli one at a time and obtained estimates of the perceptual classification of these sounds before and after speech motor learning. In studies of limb movement, we found that following learning the sensed limb position shifted reliably in the direction of the applied force. That is, when the force-field pushed the limb to the right, the sensed limb position following learning also shifted to the right ($p < 0.01$). We obtained a similar pattern of perceptual change for both left-right movements and forward-back movements and also when perceptual tests were conducted in statics and during movement. We obtained comparable findings in studies of speech motor learning. Following dynamics learning, subjects showed systematic changes in their perceptual classification of speech sounds. Individuals that displayed greater amounts of learning showed greater perceptual change. Taken as a whole, our findings are consistent with the idea that sensory change occurs broadly following motor learning.