Proprioception and prediction in visuomotor learning.

Knowing the position of one's limbs is essential for moving it and hence it makes sense that several signals provide information on limb position. This includes vision and proprioception, as well as predictive estimates based on efference copy of the movement. And while both proprioceptive and predictive estimates of hand position have been shown to change when we adapt our movements to altered visual feedback of the hand (i.e., a visuomotor rotation), it is unclear how much each contributes to adaptation induced changes in where we localize our hand. By having participants localize their hand with and without efference signal, we can start teasing the two contributions apart. Here I will discuss our results investigating predicted and perceived changes both as a function of the size and nature of visual discrepancy, and as a function of age. Furthermore, I will characterize the time course of these changes in hand localization by measuring them after every visuomotor training trial. In summary, we find that visuomotor training leads to changes in both predicted, efferent-based and proprioceptive, afferent-based estimates of the hand. These changes in proprioceptive-based estimate were larger in older adults compared to young adults. These changes in localizing the unseen hand position emerge even when it's clear that the source of the errors isn't due to the hand or motor system at all. Moreover, these hand localization shifts occur very rapidly, but mainly reflect changes in the proprioceptive-based estimates. These findings imply that estimates of hand-position are quite malleable, but that this plasticity in our estimates of limb position depends on multiple sources of feedback, and our brains likely considers the peculiarities of the separate signals to arrive at a robust limb position signal.

Bio: Denise Henriques is a full professor in the School of Kinesiology and Health Science at York university, and is an active member of York's Centre for Vision Research. She also coordinates the Graduate neuroscience-diploma program and the Undergraduate program in neuroscience at York university, and directs a NSERC-CREATE international research training program in Brain in Action with partners at Western and Queens, and in Giessen and Marburg. Her research involves understanding how spatial information for action is coded and updated, and how the brain uses and integrates multisensory information to control and adapt movements, mainly those of the hand. Her work on sensorimotor control and learning has led several early-career awards including an Ontario Ministry of Innovation Early Researcher Award (2007), and the Alfred P Sloan Fellowship (2009), as well as many international seminar invitations.