

# Immediate Neural Plasticity Shapes Motor Performance

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The consolidation of motor skills necessitates long-lasting changes in the nervous system. For the most part, plasticity has been documented in motor systems after training and long-term adaptation. However, there has been no demonstration of immediate neural changes associated with the rapid adaptation of motor behavior required to interact with a dynamic environment. To address this issue, we explored the changes in performance (reaction time) of rhesus monkeys that executed saccadic eye movements to one of two visual stimuli while monitoring the preparatory activity of neurons in the superior colliculus, a structure close to the motor output. Similar to the well established sequential effects observed in human manual responses, each monkey displayed reaction times to target locations that were organized in a sequential pattern, becoming progressively shorter with each preceding repeated movement and longer with each preceding nonrepeated movement. This sequential pattern of performance modification was associated with concordant changes in the preparatory activity of superior colliculus neurons in advance of the saccadic target presentation. These data indicate that neural properties are continuously shaped by use-related experience in a manner consistent with the progressive adaptation of motor behavior.

**Key words:** superior colliculus; saccade; reaction time; motor preparation; motor learning; sequential effects; repetition effect; oculomotor; gap paradigm; monkey