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From visual to motor strategies: training in mental rotation of Hands

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Abstract

Functional imaging studies on mental rotation of hands have consistently pointed to the importance of the motor network implying the use of motor simulations for task solving. There is some evidence that the putamen may be a critical modulator of processing egocentric spatial orientation in mental rotation of hands and implicit motor imagery strategies have been described involving hand motor areas. This recruitment of resources processing representations of the own body is used in therapeutic mental rotation training. However, studies are lacking that investigate training-induced changes on the neuronal level. We used functional MRI to study the effects of long-term training on the neuro-functional correlates of mental rotation of hands in healthy volunteers and compared the training group to a passive control group. From pre- to post training, we found a transition of activation from the anterior putamen in unskilled performance to the posterior putamen in skilled performance. We also found an increase in activation in motor cortices and the supramarginal gyrus after learning. By contrast, members of the control group showed no improvements in performance and no pre/post-test differences in cortical activity. In conclusion, these findings suggest that increased neural efficiency after training in mental rotation of hands manifests as a decrease in visual imagery in conjunction with increased recruitment of motor-related regions. This is consistent with the obtained behavioral effects depicting motor imagery mediating expertise in mental rotation of hands.

Keywords: mental rotation, putamen, parietal sulcus, motor imagery

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