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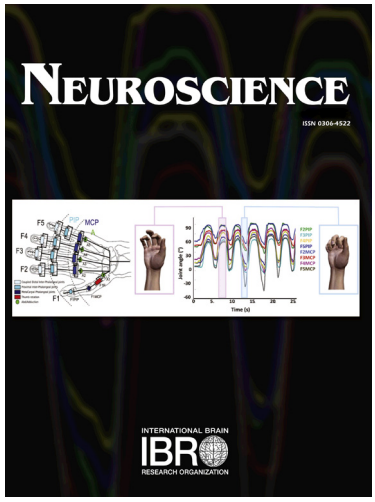

Theta neurofeedback effects on motor memory consolidation and performance accuracy: An apparent paradox?

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Abstract

Previous studies have shown that theta neurofeedback enhances motor memory consolidation on an easy-to-learn finger tapping task. However, the simplicity of the finger tapping task precludes evaluating the putative effects of elevated theta on performance accuracy. Mastering a motor sequence is classically assumed to entail faster performance with fewer errors. The speed-accuracy tradeoff (SAT) principle states thatas action speed increases, motor performance accuracy decreases. The current study investigated whether theta neurofeedback could improve both performance speed and performance accuracy, or would only enhance performance speed at the cost of reduced accuracy. A more complex task was used to study the effects of parietal elevated theta on 45 healthy volunteers The findings confirmed previous results on the effects of theta neurofeedback on memory consolidation., In contrast to the two control groups, in the theta-neurofeedback group the speed-accuracy tradeoff was reversed . The speed-accuracy tradeoff patterns only stabilized after a night's sleep implying enhancement in terms of both speed and accuracy.

1. Introduction

The memory of motion patterns is crucial to human functioning and can range from learning a new hand gesture to a new dance sequence, or making an accurate surgical incision. Motor memory consolidation Here we look for processes associated with memory consolidation of motor sequences, and focus on accuracy of motor movements as related to day-time consolidation.

Consolidation of motor sequences, i.e. enhancing memories beyond stabilization, has been shown to correlate with sleep (Censor et al., 2006; Karni et al., 1994; Walker & Stickgold 2004), and with theta rhythms (Buzsaki 2002) especially during sleep (Boyce et al., 2016; Diekelmann & Born, 2010; Heib, et al., 2015; for a review see Cohen et al., 2015). One of the first pioneering studies providing evidence for the relationship between