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Infographic

Infographic: Neuroscientific approaches to increase motor automaticity

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ABBREVIATIONS
EF External focus

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INTRODUCTION

Motor learning can be conceptualized as a continuum process in which individuals became more skillful as they practice. In advanced stage of learning, movement automaticity is reached. The gain in automaticity can be inferred by different characteristics such as a reduction in mental effort spent or even through behavioral measures such as a higher frequency of postural adjustments [1]. Although automaticity occurs through practice, studies have shown that it can be accelerated by different factors. One example of a factor that can accelerate automaticity is the direction of the focus of attention to an external focus (EF). It has been suggested that EF induces optimal behavior by taking maximum advantage of using less explicit resources and mental effort [2].

While motor behavior studies have sought to use different factors to favor the reduction of mental effort, and further, motor learning, neuroscientific approaches such as neurofeedback and biofeedback have a greater potential to deal with the mental effort in practice contexts. Therefore, the mental effort can be assessed and fed back to a learner during/before practice through “self-induced” neuromodulation. This procedure is often termed “neurofeedback” since it is used to direct an arbitrary initial mental state to a target state which is based on the establishment of an optimal control point. However, as it comprises a subdivision of biofeedback that deals with the modulation of mental activity, the procedure can also be performed with indirect-mental activities. According to TAO et al. [3], mental effort can be accessed not only by direct-mental activity measures such as EEG parameters but also with different indirect biological signals such as oculomotor measures (e.g., pupil dynamics) and electrocardiographic measures (e.g., heart rate variability).

In neurofeedback procedures, the strength of mental activity can be translated by different modalities of feedback (e.g., visual, auditory, etc.) to provide awareness, bringing information about relevant changes in mental states. The monitoring of this mental state further creates a closed-loop system that allows the involvement of the individuals in their biological processes so that they can actively regulate their neural activity. Given the high relevance of the assessment of mental effort spent in practice, which has been brought by the motor behavior literature [4,5], it is imperative to understand the effects of direct regulations of mental effort on motor learning.

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