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The state-dependency of inhibitory control plasticity

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Executive functions are a set of cognitive processes involved in organizing behavior to achieve complex goals, which notably include shifting between tasks, updating information and inhibiting irrelevant cognitive and motor processes. The present thesis focuses on this latter function, namely “inhibitory control” (IC), and especially on how it can be improved with training. Indeed, while IC is highly susceptible to training-induced behavioral and brain plasticity, whether and how the parameters of the training intervention and the specificity of the trained population influence IC plasticity remains largely unresolved. These questions were addressed with three studies:

In the first study entitled “Enhancing frontal top-down inhibitory control with Go/NoGo training” (Hartmann, Sallard, & Spierer, 2016), we show that systematically varying the stimuli used for the NoGo trials during an inhibition task helps preventing task automatization and in turn reinforcing frontal top-down (controlled) inhibition processes. The behavioral improvements in the tested training intervention were associated with a decrease of the right prefrontal brain activity in response to NoGo trials, a finding interpreted as reflecting an increase of top-down inhibition efficiency.

In the second study entitled “Modulation of reward responses with inhibitory control training” (in revision), we compared the brain modulations induced by training IC to rewarding versus neutral stimuli. The results show that the training modulated differently the brain responses to the different types of stimuli during the initiation of the inhibition processes within the frontal cortex and key nodes of the reward system. This indicates that the effects of IC training are stimuli-dependent and influence the representation of the trained stimuli.

Third, we investigated whether the age of the trained population influences the effects of training in a study entitled “Inhibitory control training in elderly: towards a youthlike functional organization” (in revision). The results revealed different effects of training between the groups on ERP-components related to inhibition (N2 and P3), driven by a decrease in supplementary motor area activity and an increase in left ventrolateral prefrontal activity in the elderly but not the young population. These results suggest that the effects of IC training are also age-dependent.

Our collective findings for the dependency of the effects of training on 1) the training parameters, 2) the stimuli used during the training and 3) the trained population not only stress that these aspects must be taken into account when designing training-based interventions for inhibition-related disorders, but also that training interventions could be optimized to target specific neurocognitive processes.

Jury :

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