WHEN EMOTIONS MEET ACTIONS

Sara Borgomaneri

Institution Alma Mater Studiorum, University of Bologna, Italy

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Background: Actions and emotions are intricately linked, and yet their relationship is not yet clear. Interestingly, the inhibitory control has been found to be less efficient in the face of emotional stimuli. However, contradictory results have been reported. Moreover, investigating brain processes that make humans able to prevent undesired actions represents a key scientific challenge that has been relatively neglected.

Aims: We aim to disclose the complex interplay between action control and emotions, investigating how emotional stimuli are able to behaviorally influence action control as well as the neural dynamics subtending such complex executive function.

Methods: In a series of behavioral and Transcranial Magnetic Stimulation (TMS) studies, we asked healthy young participants to complete an action control task called Stop Signal Task (SST). The SST is useful to assess the ability to suppress an ongoing action, requiring participants to respond to a go signal and withhold their response when a stop signal appears. We investigated how action control capabilities can be ameliorated or suppressed due to different TMS protocol applications and whether individual neurophysiological indices may predict action suppression abilities.

Results: We demonstrated that negative emotions are able to influence action control and that the neural dynamics subtending action suppression are differently influenced in a neutral vs an emotional context. Interestingly, individual differences in intracortical mechanisms within the motor system may be considered as a biomarker for action control capabilities.

Conclusions: Our results significantly advance the mechanistic understanding of the complex interplay between action and emotion, demonstrating that negative emotions can ameliorate action suppression. Taken together, our results pave the way for future TMS-based treatments in several psychiatric and clinical disorders with serious deficits in action control, especially in emotion-related contexts.

Keywords: Action inhibition, Transcranial magnetic stimulation, Emotion perception

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Battaglia, S., Nazzi, C., di Fazio, C., & Borgomaneri, S. (2024). The role of pre-supplementary motor cortex in action control with emotional stimuli: An rTMS study. *Annals of the New York Academy of Sciences*, *1536*, 151–166. https://doi.org/10.1111/nyas.15145

Cardellicchio, P., & Borgomaneri, S. (2025). Level of M1 GABAB predicts micro-offline consolidation of motor learning during wakefulness. *NPJ Science of Learning*, *10*, 10. https://doi.org/10.1038/s41539-025-00299-1

Quettier, T., Ippolito, G., Cardellicchio, P., Battaglia, S., & Borgomaneri, S. (2024). Individual differences in intracortical inhibition predict action control when facing emotional and neutral stimuli. *Frontiers in Psychology*, *15*, 1391723. https://doi.org/10.3389/fpsyg.2024.1391723

E-mail contact: sara.borgomaneri@unibo.it