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# Grounding meaning in the motor system: A p-curve analysis of the TMS and tDCS evidence

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## Abstract

According to the embodied cognition view, retrieving the meaning of action-related language requires the participation of sensorimotor processes. In consequence, an increasing number of neurostimulation (TMS and tDCS) studies have tried to test this idea. In the present study, we aim to evaluate the evidential value of this body of research ( $N = 43$ ) by means of p-curve analyses. Our results suggest that the published studies so far do not yet allow to establish if they explore real effects beyond a reasonable doubt. We also found that these studies are quite underpowered (estimated power  $< 30\%$ ), which suggests that a large percentage of these findings are, in fact, false-positive results. In sum, our study suggests that the results derived from brain stimulation studies of embodied semantics are not as reliable as would be desirable. We give some recommendations that will be important for future research on this topic.