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Noninvasive stimulation over the left motor cortex influences learning of a novel action word lexicon

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Background: The embodied cognition theory suggests that motor cortical areas are automatically accessed and necessarily involved in the understanding of action words. A corroborate body of evidence has delineated the engagement of motor cortical areas during different linguistic, especially semantic tasks. According to Hebb's associative model it has been proposed that during language acquisition the frequent co-occurrence of action words and action performance finally leads to hardwired connections of perisylvian areas, which process word form, with the motor cortex, where action-related semantic concepts are grounded. However, it has not been investigated yet whether interference with motor cortical processing affects the acquisition of action words. *Method:* We probed the functional relevance of the motor cortex for learning a novel action word vocabulary with transcranial direct current stimulation (tDCS) over the left primary motor cortex (M1) in 30 young, healthy subjects. In a separate population of 27 young, healthy volunteers, tDCS was applied over the left dorsolateral prefrontal cortex (DLPFC) as a control condition. In a placebo-controlled double-blind and randomized parallel design, each subject received daily either anodal, cathodal (VERUM groups; 1mA, 20 min) or sham (PLACEBO group) tDCS over 4 consecutive days (days 1-4). *Results:* After application of tDCS, subjects were trained in a novel vocabulary of 76 concrete action words by means of an associative learning paradigm. Cathodal tDCS over M1 compared to sham tDCS significantly affected transfer of novel action words to the native language. tDCS over DLPFC did not affect language learning. *Conclusion:* The results lend evidence that the left motor cortex is involved in the acquisition of a novel action word vocabulary.