

Name: Kinsey Bice
Affiliation: University of Washington
Position: Psychology
Email: biceroni@gmail.com
Email 2:
Address: 2222 NE 92nd St
Address 2: Apt 112
City: Seattle, WA 98115
Country: United States
Work Phone: 6086691635
Fax:

Co-Author

Name: Chantel Prat
Affiliation: University of Washington
Position:
Email: csprat@uw.edu
Address:
Address 2:
City: ,
Country:
Work Phone:
Fax:

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Abstract Information: Transcranial Direct Current Stimulation Influences Reliance on Declarative vs. Procedural Learning

Abstract Text: Successful language learning requires an intricate and dynamic balance between declarative and procedural mechanisms, yet individuals may rely differentially on one or the other in less than optimal ways. The goal of the current experiment was to determine whether transcranial direct current stimulation (tDCS) can tip the balance, specifically facilitating declarative or procedural learning. Previous research has shown that left temporal stimulation improves word retrieval in healthy adults, and that frontal stimulation augments brain activity related to reinforcement learning. We therefore predicted that anodal stimulation of the left temporal lobe would enhance an individual's reliance on declarative memory, whereas anodal stimulation of the medial/left-lateralized frontal lobe would enhance an individual's reliance on procedural learning. Seventy-nine subjects (31 no stimulation, 16 sham stimulation,

16 frontal stimulation, 16 temporal stimulation) completed an artificial grammar learning task followed by a two-alternative forced-choice test that measured sensitivity to the underlying artificial grammar versus features of the surface form. The results confirmed our predictions. Frontal stimulation resulted in more frequent selection of grammatical strings than baseline ($\beta = .03$, $t = 2.09$, $p = .04$) or temporal stimulation groups ($t(30) = 1.77$, $p = .04$). In contrast, left temporal stimulation resulted in higher selection of strings with familiar surface features than baseline ($\beta = .03$, $t = 2.13$, $p = .04$) or frontal stimulation groups ($t(30) = 1.95$, $p = .03$). We conclude that tDCS may be used to facilitate engagement of different learning systems required for language learning.



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