

Personality traits modulate the effect of tDCS on reading speed of social sentences

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Introduction

Mentalizing network & STS

Intentionality is basic for understanding social relationships (SRs). The mentalizing network encodes intentionality^{1,2}, especially, the superior temporal sulcus (STS) in processing social intention^{3,4}, particularly approach intentionality⁵.

In this regard, an enhancement in memory for approach sentences, (e.g. "Cristian accepted Daniela on Whatsapp") has been shown after anodal tDCS on rSTS⁶.

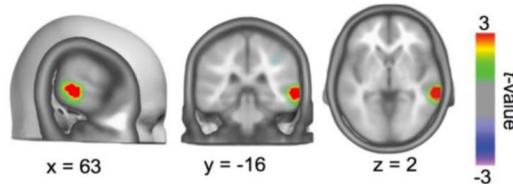


Figure 1: Source localization of approach/avoidance difference in the ERP window (545-750 ms). Stronger activation for approach than avoidance is shown in BA 21-22 (taken from Marrero et al., 2020).

However, tDCS advantage might start before, in sentences reading. Hence, we examined the effect of anodal tDCS on rSTS on reading speed of SRs sentences. We hypothesized anodal tDCS would produce a greater improvement for approach sentences.

The role of personality traits

A 2-dimensions model of personality was considered⁷: anxiety (BIS) and impulsivity (BAS). The BIS/BAS scales⁸ were given to participants. We hypothesized a poorer improvement after anodal tDCS in reading speed for approach and avoidance sentences in high-BIS and high-BAS participants in contrast to low-trait participants.

Method

Participants

- N = 62 healthy right-handed students (54 females M= 19,95, SD = 2,33).
- All participants provided informed consent.

Stimuli & Task

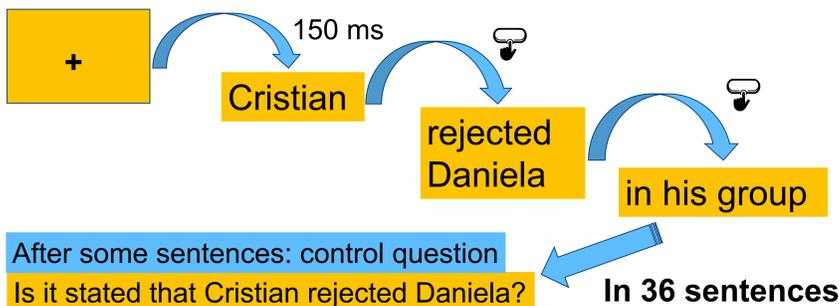


Figure 1: illustration of an avoidance sentence presentation (response recordings and stimuli presentation were controlled by E-Prime 2.0 software).

tDCS Montage

2 rubber electrodes:

- 5cm X 5 cm (0.08mA/cm²) → T8
- 7cm X 5 cm (0.057mA/cm²) → Left shoulder

Set (20 Ap. / 20 Av. / 20 Neu.)

Fade in: 15 s

2 mA: 20 min / 15 s

Fade out: 15 s

Set (20 Ap. / 20 Av. / 20 Neu.)

Figure 2: Structure of an experimental session

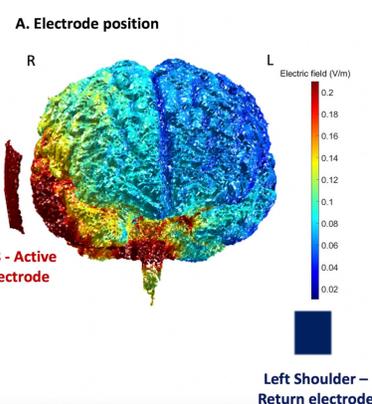


Figure 3: representation of our electric field run using ROAST⁹. Units are in V/m.

Results

Design

- Three 3 X 2 mixed Two-Way ANOVAs were performed.
- Within-subjects: Direction (Approach, Avoidance, Neutral).
- Between-subjects: Stimulation (Anodal, Sham).
- DV → d (improvement in reading speed in 2nd set).
- Covariate → Latency to neutral questions.

General ANOVA

Two participants were removed (questions failed > 25%), N = 60
-Stimulation, $F(1, 58) = 4.174, p < .05, \eta^2 = .068, d \text{ anodal} > \text{sham}$
-Direction, $F(2, 59) = 2.896, p = .064, \eta^2 = .094, d \text{ approach} > \text{av. \& neu.}$

Moderation by traits

-Low-BIS (n = 21): Stimulation, $F(1, 19) = 8.502, p < .01, \eta^2 = .321$
Stimulation x Direction, $F(2, 19) = 3.181, p = .067, \eta^2 = .272$
-Low-BAS (n = 21): Stimulation, $F(1, 19) = 6.53, p = .02, \eta^2 = .205$

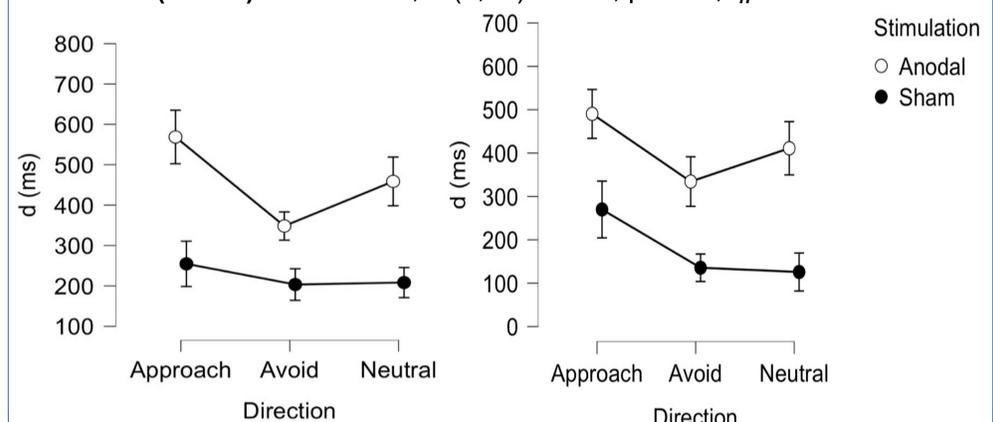


Figure 4: low-BIS d scores in each condition.

Figure 5: low-BAS d scores in each condition.

Conclusion & Discussion

- Anodal tDCS had no effect on reading approach content.
- It had an overall effect on reading speed.
- Affective traits have emerged as a modulator for tDCS effect.
- High level in BIS/BAS traits predicted a poorer benefit from anodal tDCS.
- Low level in BIS/BAS traits seem to be benefited from tDCS.

-Future research might include:

- more gender-balanced groups would be needed.
- older participants would be needed.
- a recognition task after reading to find tDCS improvement in encoding.

Hypothesis

-tDCS would produce a greater improvement in reading speed for approach sentences.

-A poorer improvement in reading speed of approach and avoidance sentences would be found in high-trait compared to low-trait participants

