Left Prefrontal Cortex Supports the Recognition of Meaningful Patters in Ambiguous Rorschach Inkblots

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Summary

- **Processing of ambiguous visual stimuli** has been associated with activation of the left lateral prefrontal cortex (PFC) in neuroimaging studies. Nevertheless, the functional role of PFC in this process is not fully understood.
- In this double-blind experiment, participants evaluated **inkblots from the Rorschach test** during stimulation of the left lateral PFC by excitatory **anodal tDCS** (transcranial direct current stimulation).
- Anodal tDCS increased the number of meaningful patterns recognized in the inkblots.
- This indicates that left lateral PFC contributes to the activation of stored visual and semantic representations, which compensate for less informative bottom-up inputs.
- Impairment of this function may contribute to disordered thought and cognition in several neuropsychiatric conditions.

For more details see:

• Bartel et al., Frontiers in Neuroscience 2020, 14:152. doi: 10.3389/fnins.2020.00152

Methods

- Participants: 40 healthy volunteers (21 males and 19 females; mean age 25.0 ± 4.2 years).
- **Experimental design:** a randomized, double-blind, betweensubjects design. The participants received either active or sham stimulation.
- **Rorschach test (ROR):** 10 inkblot tables were divided into 2 sets, counterbalanced across 2 assessment blocks (pre-test and post-test). In both blocks, 5 tables were sequentially presented on a screen in random order for 90 s. Assessed was *response fluency*, not qualitative aspects of the responses.
- Insight problems: Visual insight ability was assessed as a control measure requiring visual and conceptual restructuring and convergent thinking rather than divergent idea generation employed to interpret the equivocal ROR inkblots.
- **Procedure:** The experiment began with a baseline measurement (ROR pre-test). Immediately after the stimulation started, participants were presented with a set of six visual insight problems (5 min) and then watched a cartoon movie as a filler (for 7 min). Thereafter, the participants completed a second ROR administration (ROR post-test), which lasted until the end of the stimulation period (8 min). Immediately afterward, and participants were asked to solve the insight problems (15 min).



Stimulation



- Conductive rubber 7 × 5 cm electrodes were used. Anode was centered in between F3-F5 and cathode over Fp2 of the 10-10 EEG system (A).
- The estimated electric field intensity induced in the brain is shown in dorsal (B), left lateral (C), and frontal (D) view, based on a computational forward model of the current flow for this montage.
- DC-STIMULATOR PLUS (NeuroConn) was used to deliver stimulation.



- The number of responses in the ROR test was higher in the active group compared with the sham group (controlling for pre-test performance, ANCOVA, *p* = 0.003, panel A).
- The was no group difference in the insight score (*p* = 0.171, panel B) and solving time (*p* = 0.858, panel C).