The application of High-Definition tDCS in children and adolescents with Autism Spectrum Disorder: a study protocol for a randomized, double-blind, sham-controlled clinical trial

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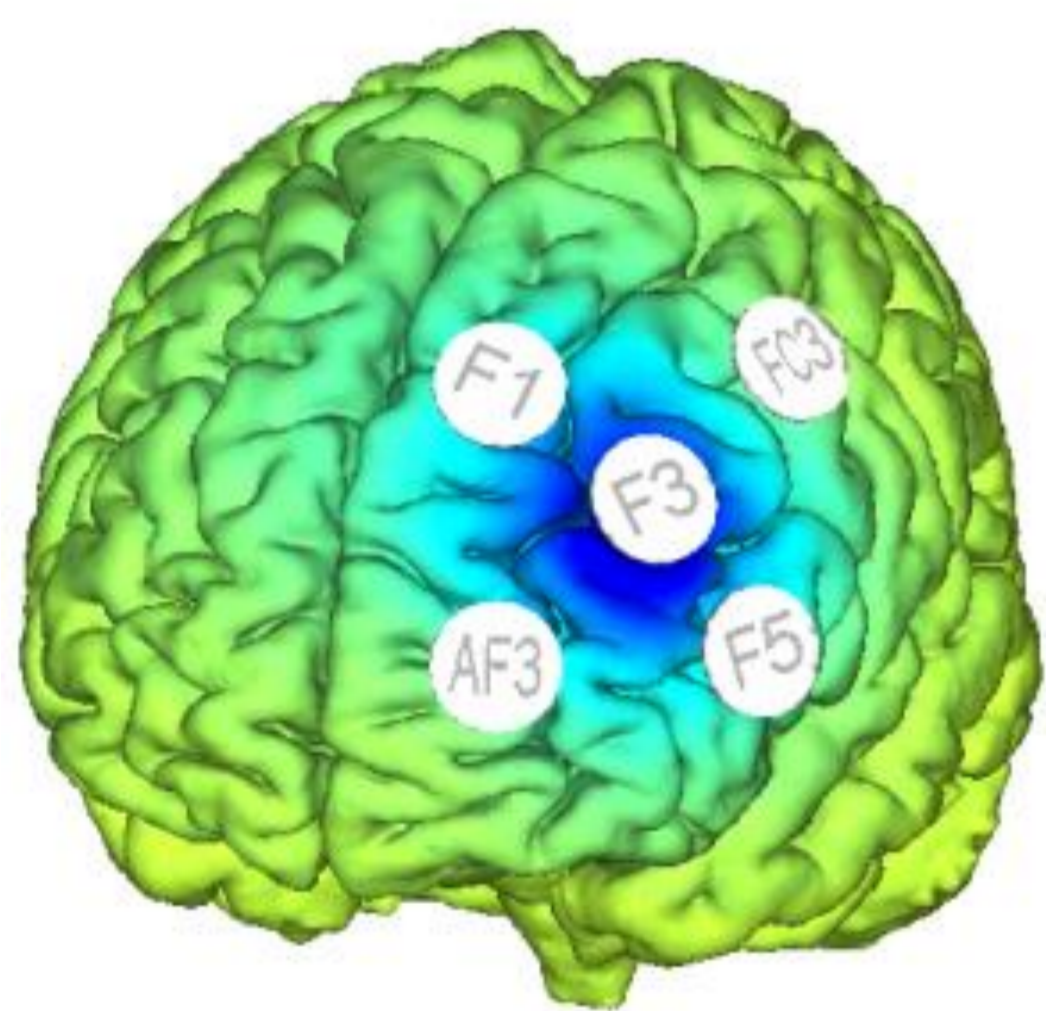
Introduction

✓ Repetitive Behaviours (RBs) remain the "forgotten symptom" in Autism Spectrum Disorder (ASD) research, and treatment options for RBs are consequently very limited, with inconsistent findings [1].

✓ Multiple studies described two subgroups of RBs: lower-order (e.g., motor stereotypies and sensory seeking behaviours) and higher-order RBs (e.g., restricted interests and adherence to routines), related with diffuse brain alterations involving: i) a sensory-motor loop including sensory-motor cortex and its descent and ascendant projections to putamen; ii) an associative loop including dorsolateral prefrontal cortex (DLPFC) and its descent and ascendant projections to caudate [2].

✓ In recent years, non-invasive neuromodulation is showing promising evidence in improving clinical and neurocognitive symptoms in individuals with ASD [3].
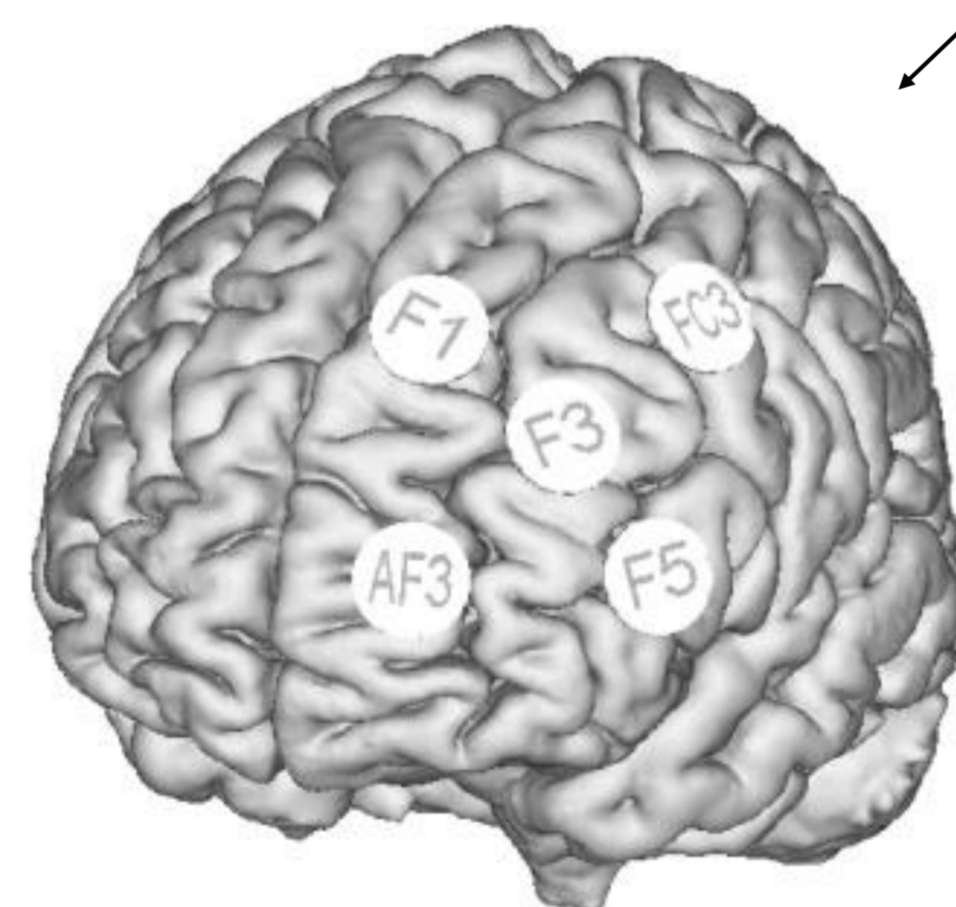
Participants

78 children and adolescents with ASD (age range 8-13), IQ ≥ 70, matched for RBs severity, age, IQ.

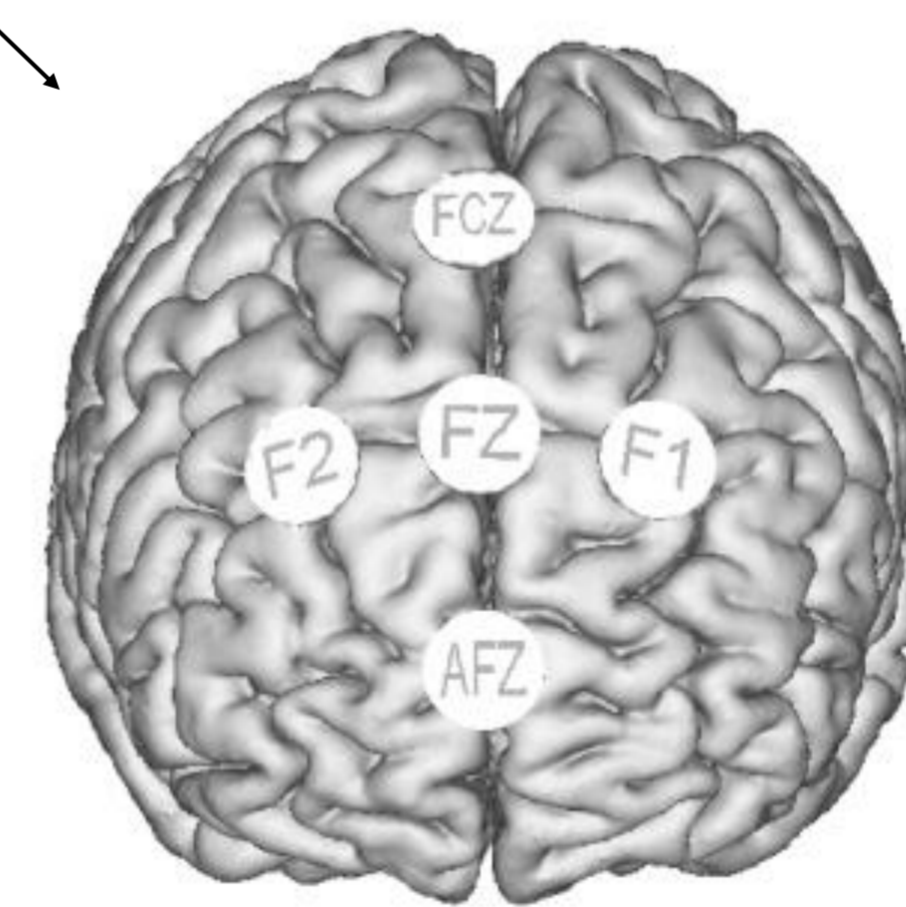**Frontal Group**
Cathodal HD-tDCS
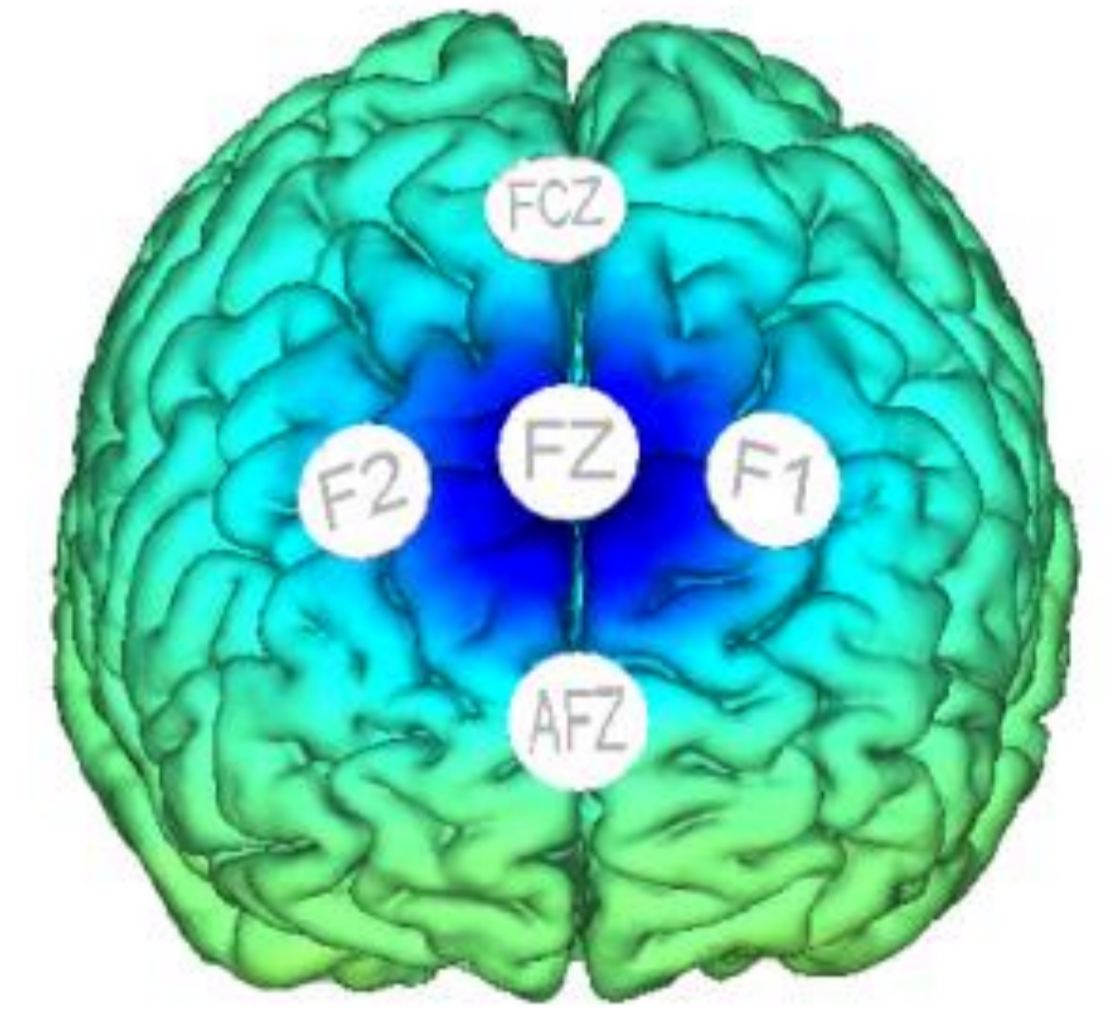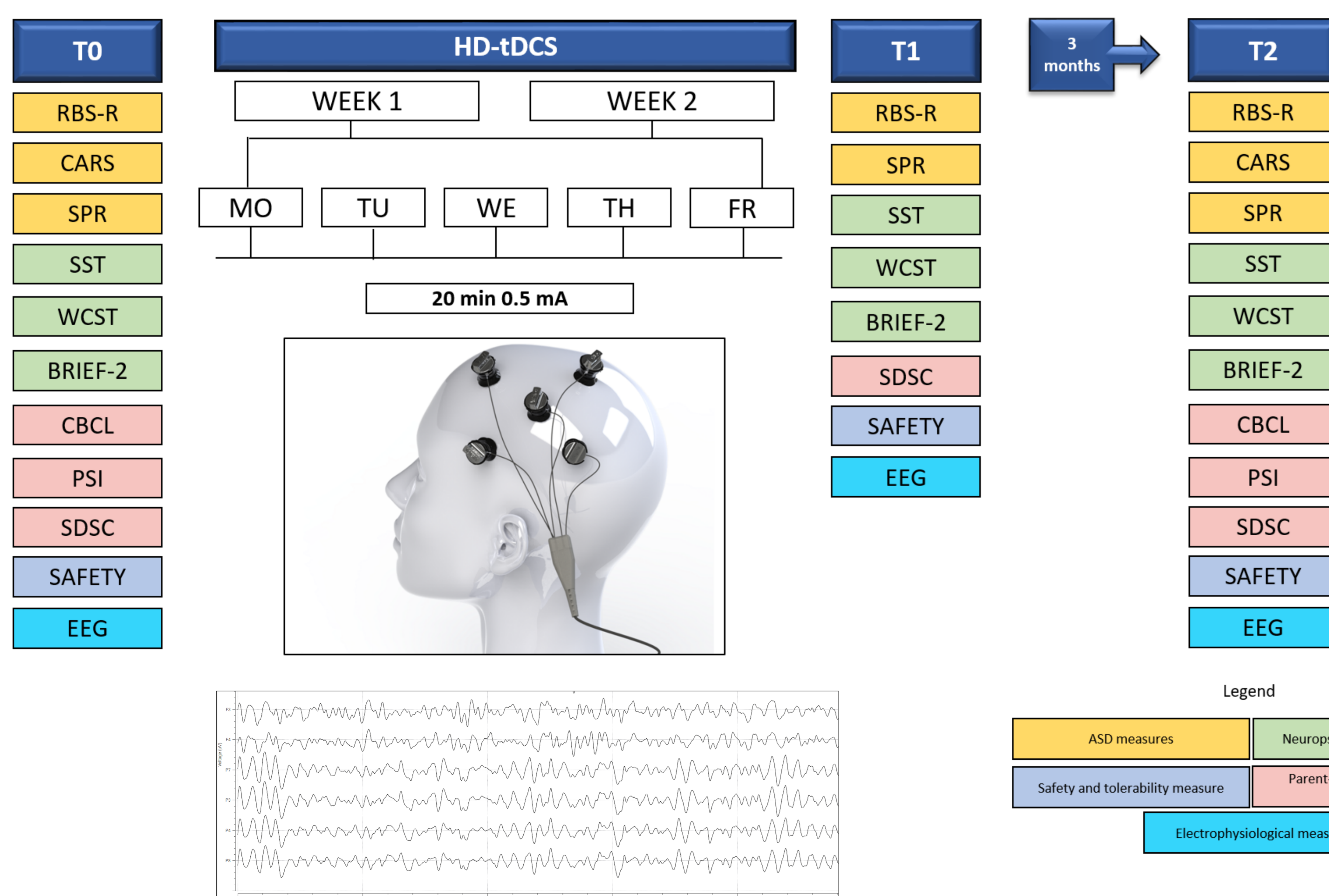over left DLPFC (F3)

Sham Group

Pre-Motor Group
Cathodal HD-tDCS
over Pre-SMA (Fz)

vs   **or**   **vs**

Methods and Instruments

T0
RBS-R
CARS
SPR
SST
WCST
BRIEF-2
CBCL
PSI
SDSC
SAFETY
EEG

HD-tDCS
WEEK 1 | WEEK 2
MO | TU | WE | TH | FR
20 min 0.5 mA

T1
RBS-R
SPR
SST
WCST
BRIEF-2
SDSC
SAFETY
EEG

3 months

T2
RBS-R
CARS
SPR
SST
WCST
BRIEF-2
CBCL
PSI
SDSC
SAFETY
EEG

Legend
ASD measures | Neuropsychological measures
Safety and tolerability measure | Parent-report psychological measures
Electrophysiological measure

Hypotheses and expected results

✓ Both Frontal and Pre-Motor Groups will improve in RBs at T1, and the effects will persist at T2, compared to the Sham Group.

✓ Participants in the Frontal Group will improve most in high-order RBs, while those in the Pre-Motor Group will improve most in lower-order RBs.

✓ Both Frontal and Pre-Motor Groups will improve in neuropsychological measures (at T1 and T2) and in other psychological dimensions associated with ASD (at T2), compared to the Sham Group.

✓ We will use EEG-data in an exploratory fashion to detect changes in functional connectivity of stimulated cortical regions.

References: [1] Harrop, C. *Autism, 2015*; [2] Langen, M. et al., *Neurosci Biobehav Rev*, 2011; [3] García-González, S. et al., *Eur Neuropsychopharm,* 2021; Salehinejad, MA. et al., *Brain Behav*, 2022.

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