Effect of tDC stimulation over left Dorsolateral Prefrontal cortex on language production in healthy late bilinguals- Preliminary results

Narges Radman, Michael Mouthon, Lucas Spierer & Jean-Marie Annoni

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LCNS LABORATORY FOR COGNITIVE AND NEUROLOGICAL SCIENCES

NIBSI Non-Invasive Brain Stimulation and Imaging Platform

UNI FR UNIVERSITÉ DE FRIBOURG UNIVERSITÄT FREIBURG

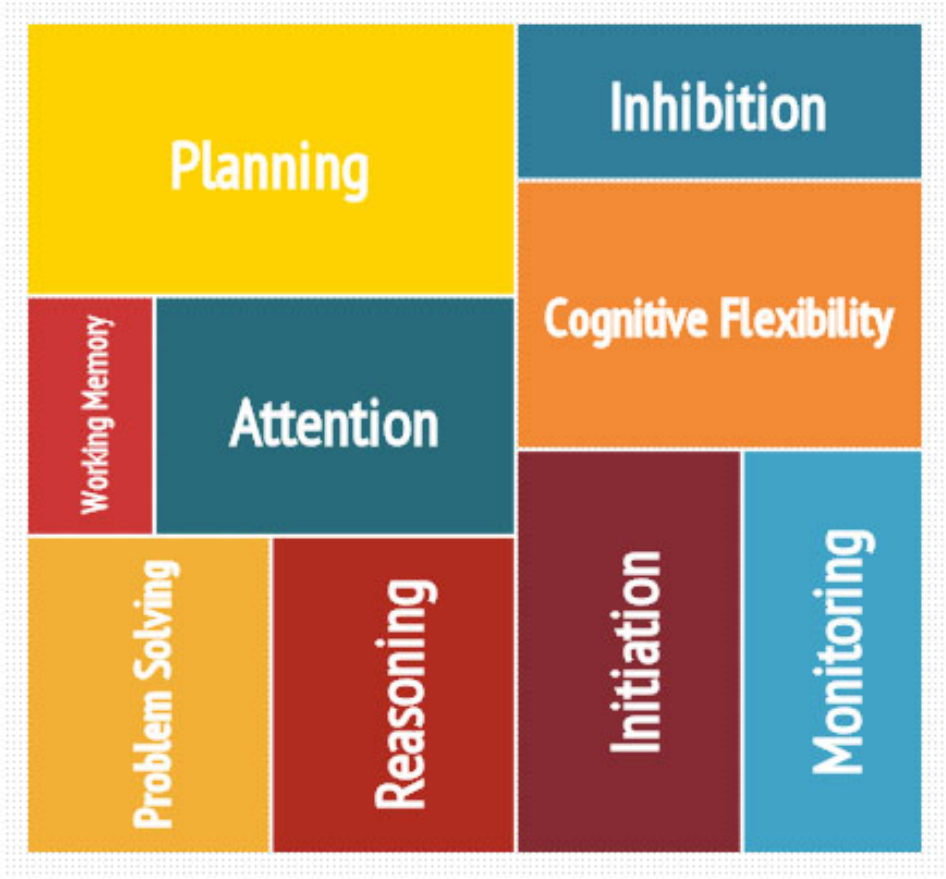
Introduction: Bilingualism

- 30-50% of the world population are bilingual
- Number of bilinguals is growing very fast.

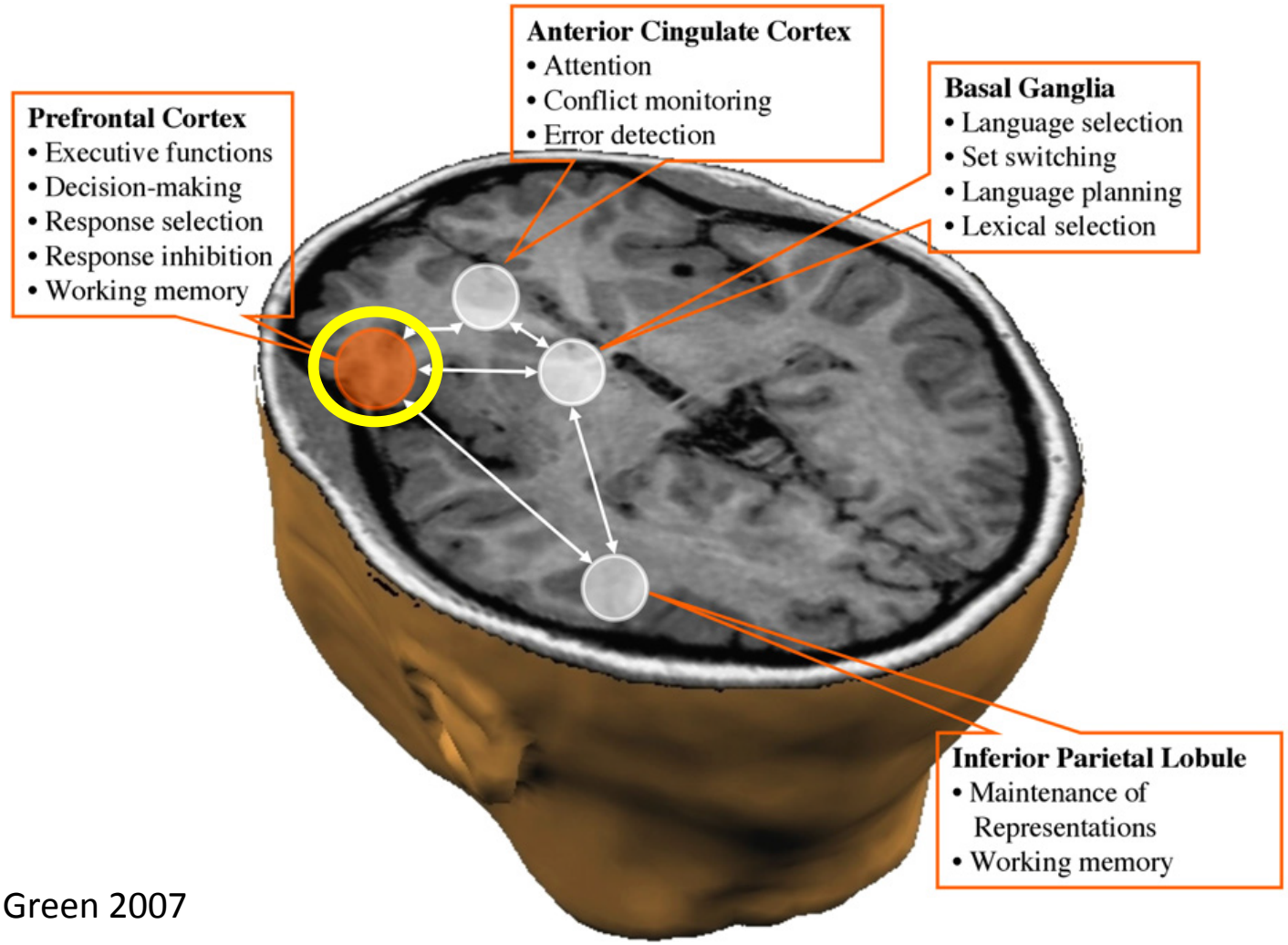
- Bilingual brain needs to manage the two languages…

Executive Function

Regulates, controls and manages thought and actions



Introduction: Executive functions and language



Abutalebi & Green 2007

Aim

Whether left DLPFC stimulation by tDCS* modulates picture naming in mother language (L1) and even more in the second language (L2).

* tDCS: transcranial Direct Current Stimulation

Methods: Transcranial Direct Current Stimulation

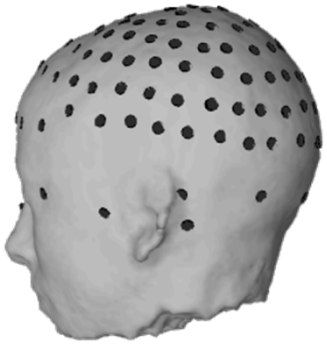
- Non-invasive, portable, well tolerated and safe neuromodulation

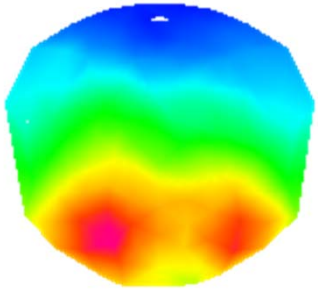
- tDCS **reliably** modulates cerebral cortical function inducing **focal, prolonged and reversible** shifts of cortical excitability

Duration: 20 minutes→ after-effect ~30 min.

Methods: Electroencephalography (EEG)

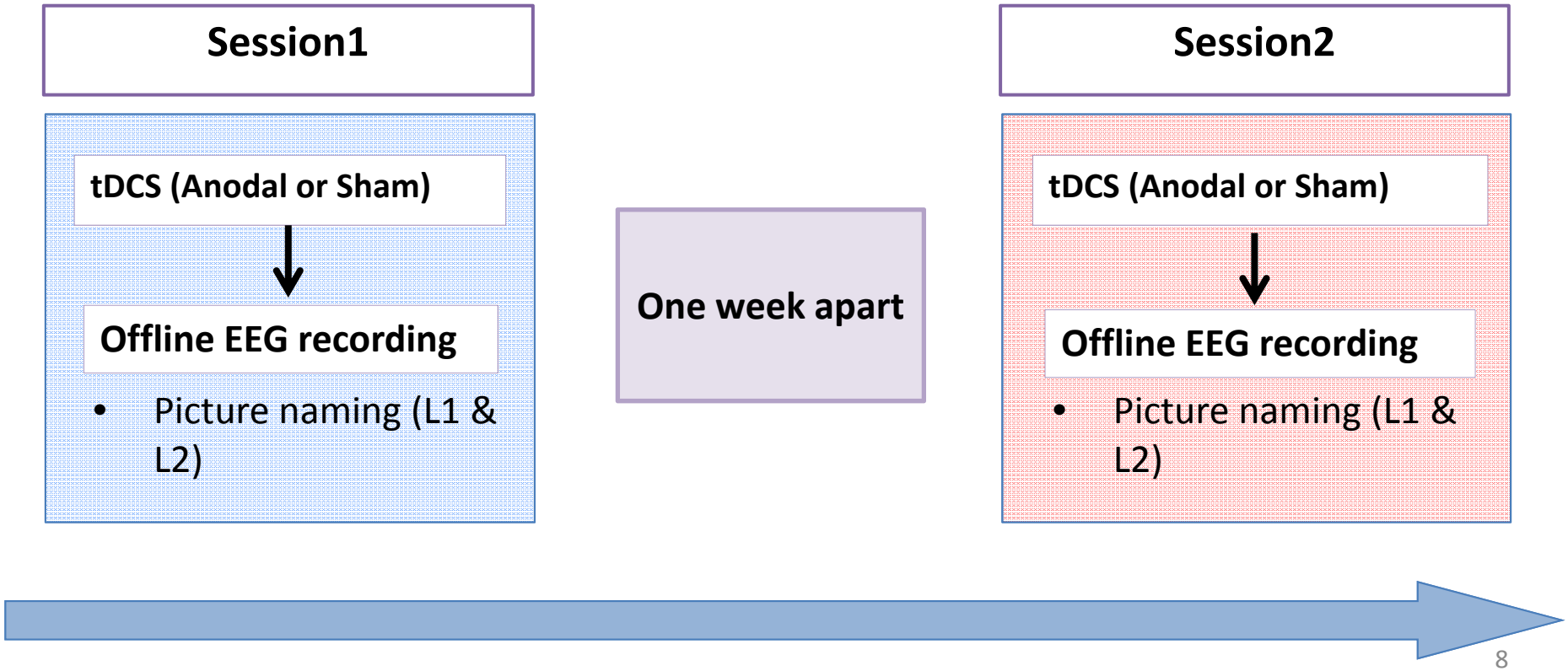
EEG: detects electrical activity in the brain using small electrodes put to the scalp.





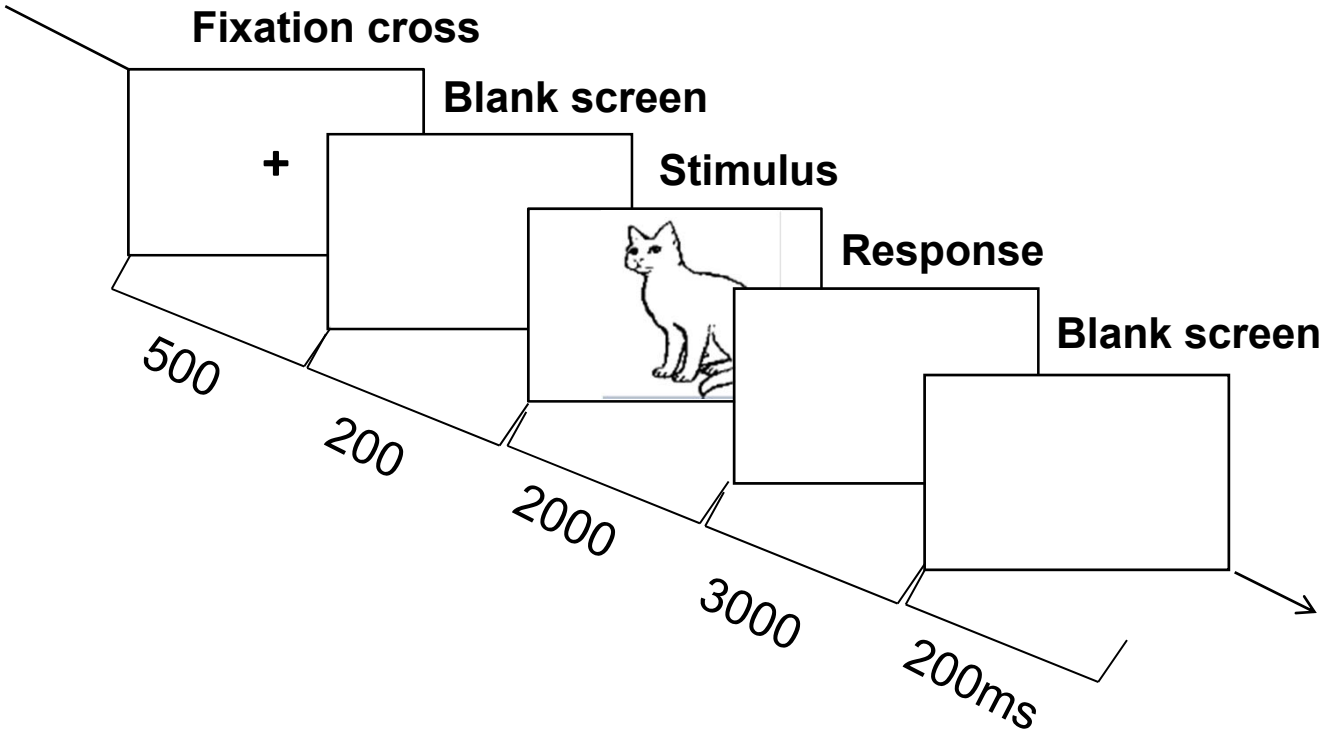
Method: Study design

Subjects: healthy, 18-45 y/o, late unbalanced bilinguals (L1 French, L2: English), right handed



Methods

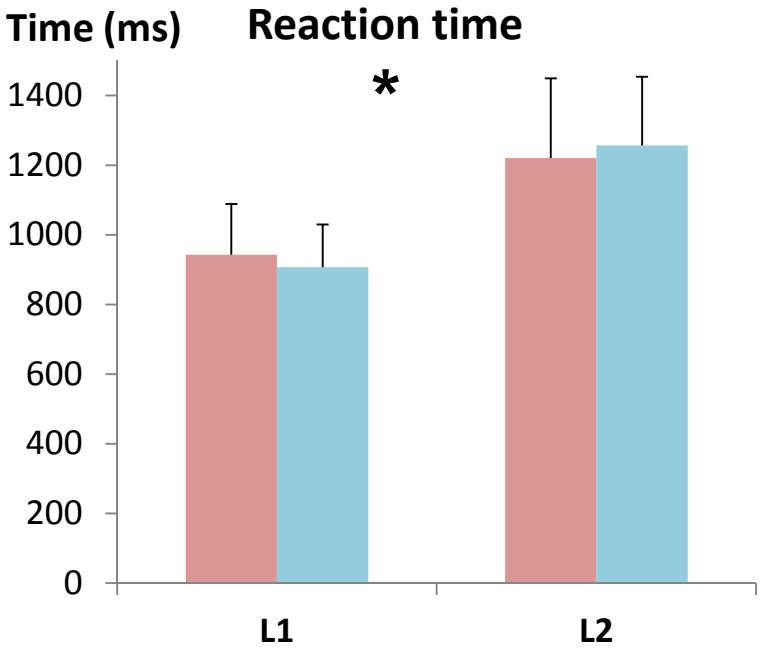
- 13 (2 males) participants, age=23.2±6.1
- L1=French, L2= English
- Picture naming task during EEG

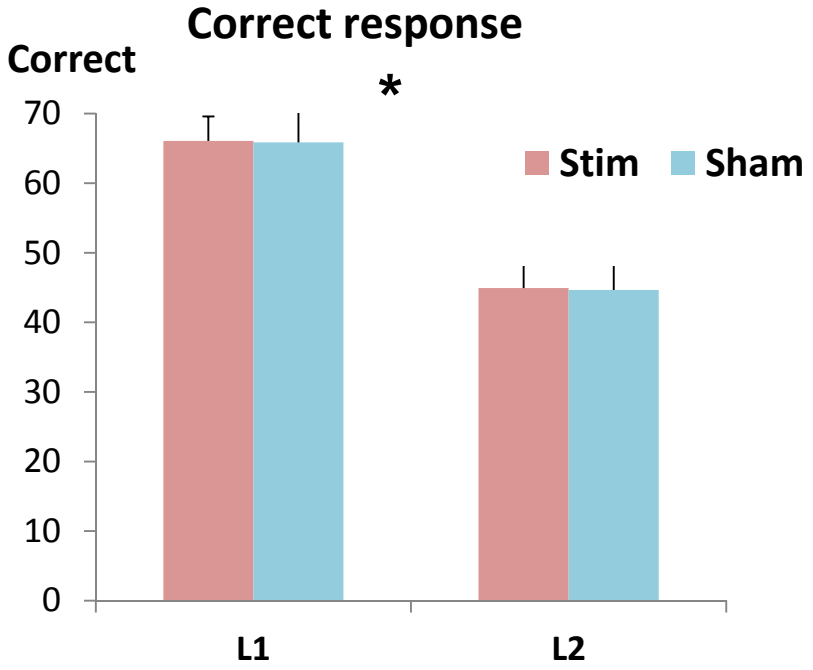


Results: Picture naming (Behavioral)

2*2 repeated measure ANOVA (Language (**L1, L2**)*Stimulation (**Sham**, **Anodal**))

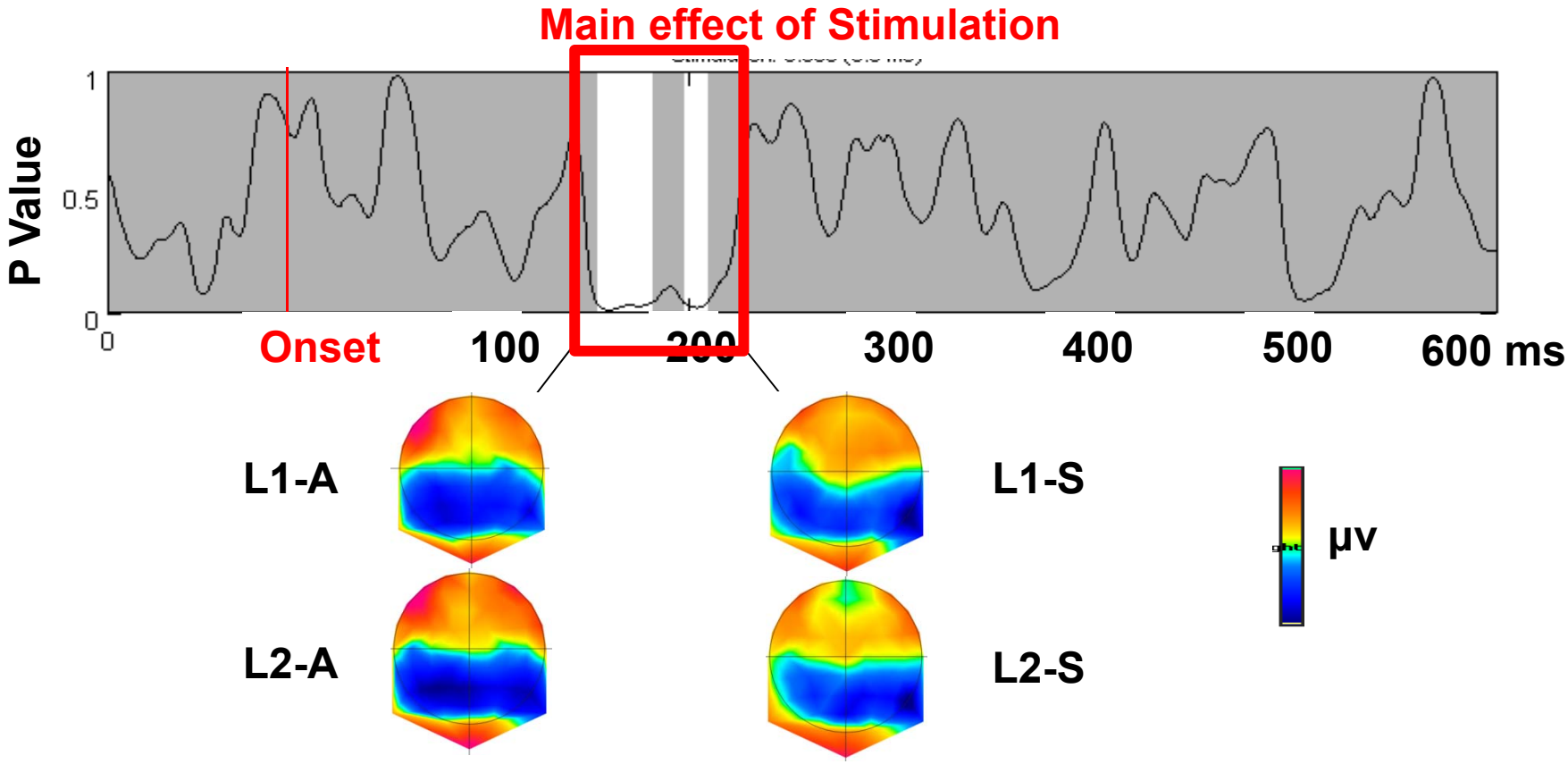
Main effect of language (p<0.001)





Results: Picture naming (EEG)

2x2 Topographic ERP ANOVA with within-subject factors Language (L1; L2) and Stimulation (Anodal; Sham)



Time window of Picture naming

Executive function involvement

Cat

0 175 270 450 600 ms

Visual & conceptual processing | Lexical selection | Phonological processing | Phonetic encoding

Main effect of Stimulation

P Value

1 .5 0

0 Image onset 100 200 300 400 500 600 ms

Conclusion

- No effect of stimulation was found on behavioral level

- **But, at neural level, tDCS over left DLPFC (associated to executive function) modifies conceptual processing and lexical selection.**

  - the effect is similar on both languages

Thanks for your attention