

Lexical processing in the occipital cortex of early blind subjects: preliminary MEG findings.

Introduction

- Occipital cortex of blind individuals is involved in speech processing (Van Ackeren et al., 2018) supporting functions that are typical of classic language regions (IMTG, ISTG).
- Alternatively, reorganized occipital regions in blind are involved in language processing but supporting more general functions related to working memory and executive control (Bedny et al., 2017 - TiCS)
- Investigating the time course of brain activity during lexical processing of speech stimuli may help disentangle these two different perspectives.
- Do occipital cortices in the blind show a lexicality effect (words vs. non-words) in the same time window as classic language areas?

Methods and Analysis

- 9 sighted ($M = 23.7$, $SD = 1.3$)
- 5 congenitally blind ($M = 35.2$, $SD = 7.2$)
- 240 words, 240 pseudowords
- Lexical decision task (delayed response)

MaxFilter + realign

Preprocessing (hp 1 Hz, lp 30 Hz)

Artifact rejection

Import subject anatomy

Head model (Overlapping spheres)

Noise covariance (from pre-stim interval)

Trials average

Source estimation

- Minimum norm imaging
- Current density map
- Unconstrained sources

Difference between conditions

Z-scores normalization (0-300 ms)

Flatten (norm of 3 source orientations)

Project on cortex template

Compute grand average

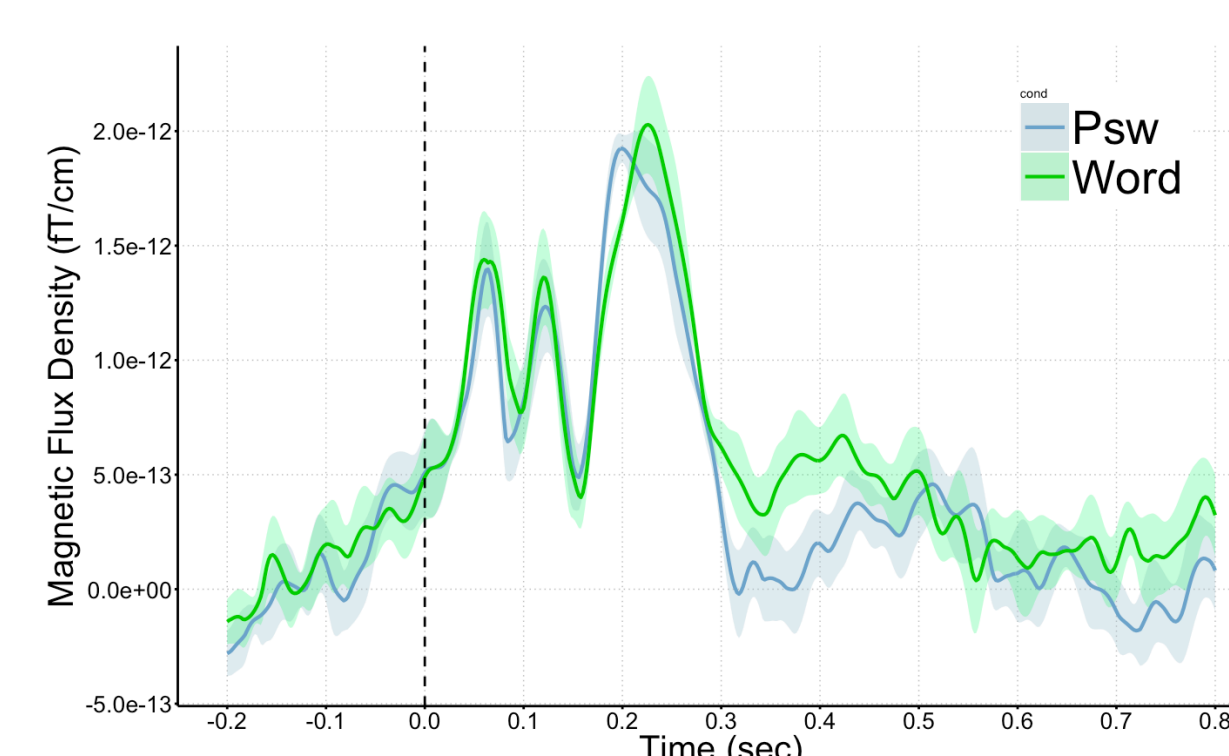
Spatial smoothing (3mm)

Subject level

Group level

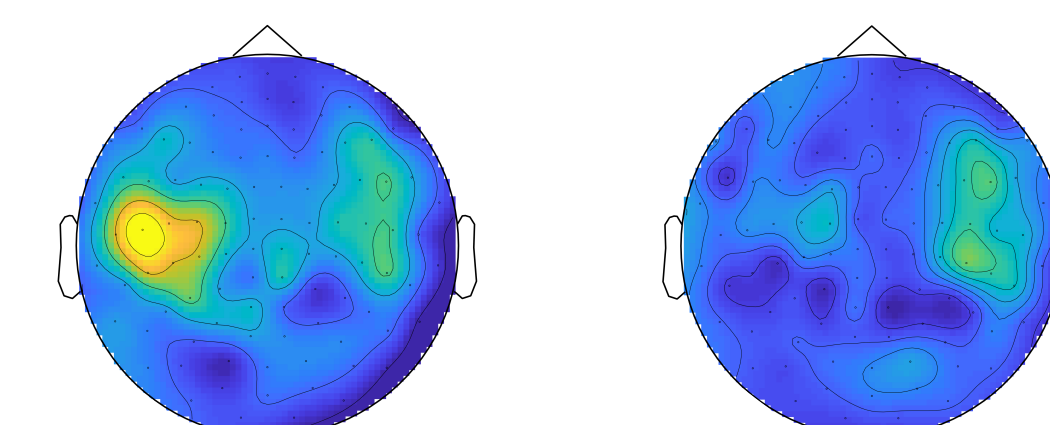
Results

Sighted



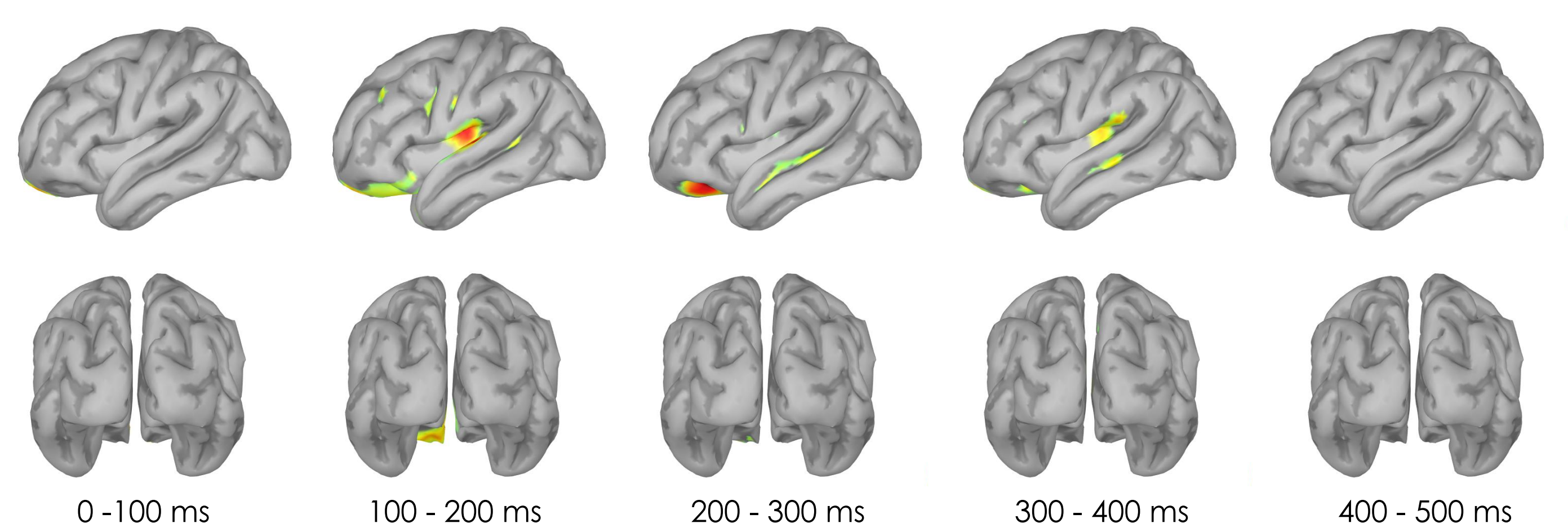
Word

Psw

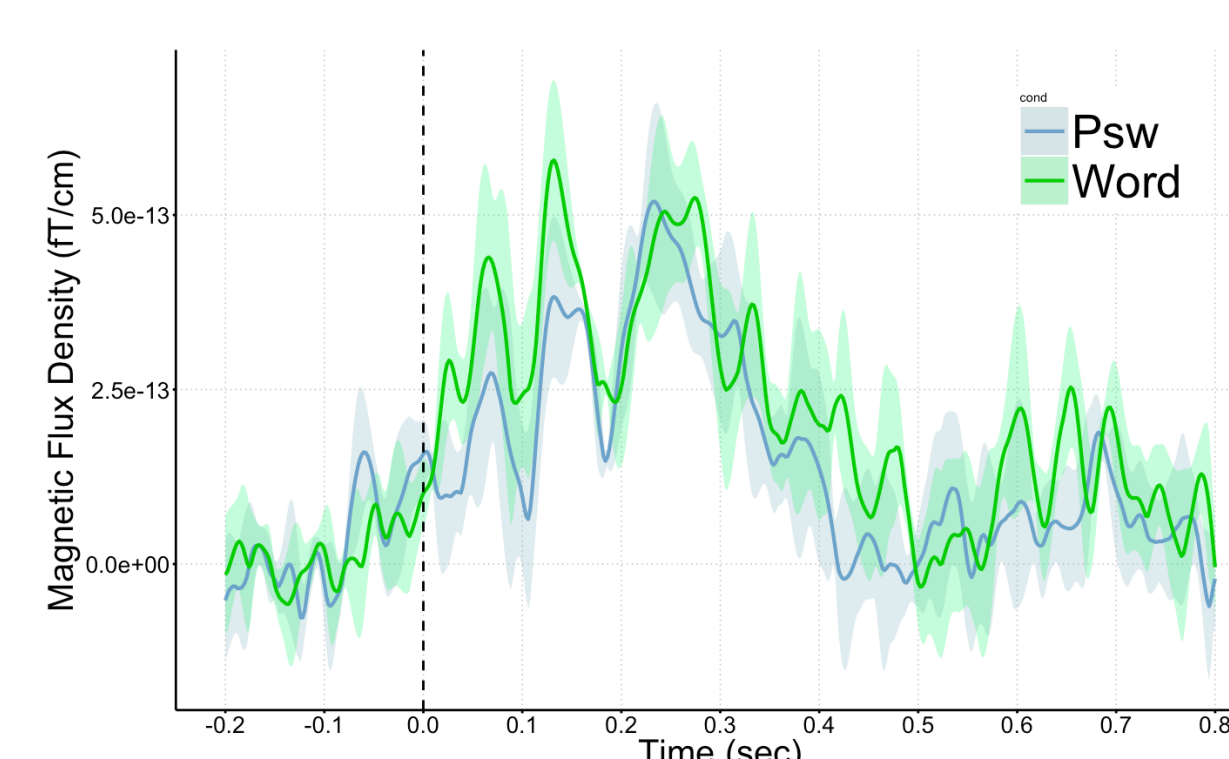


300-400 ms

Norm [Zscore(Psw) - Zscore (Word)]

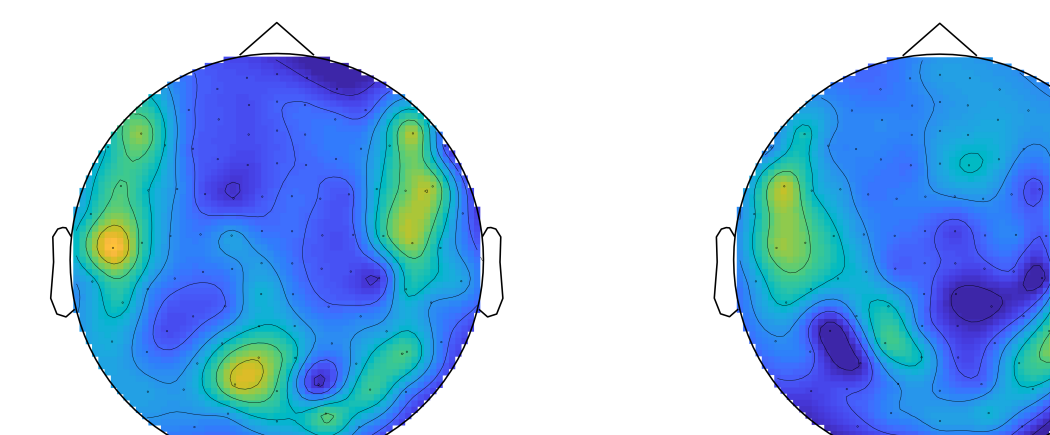


Early blind



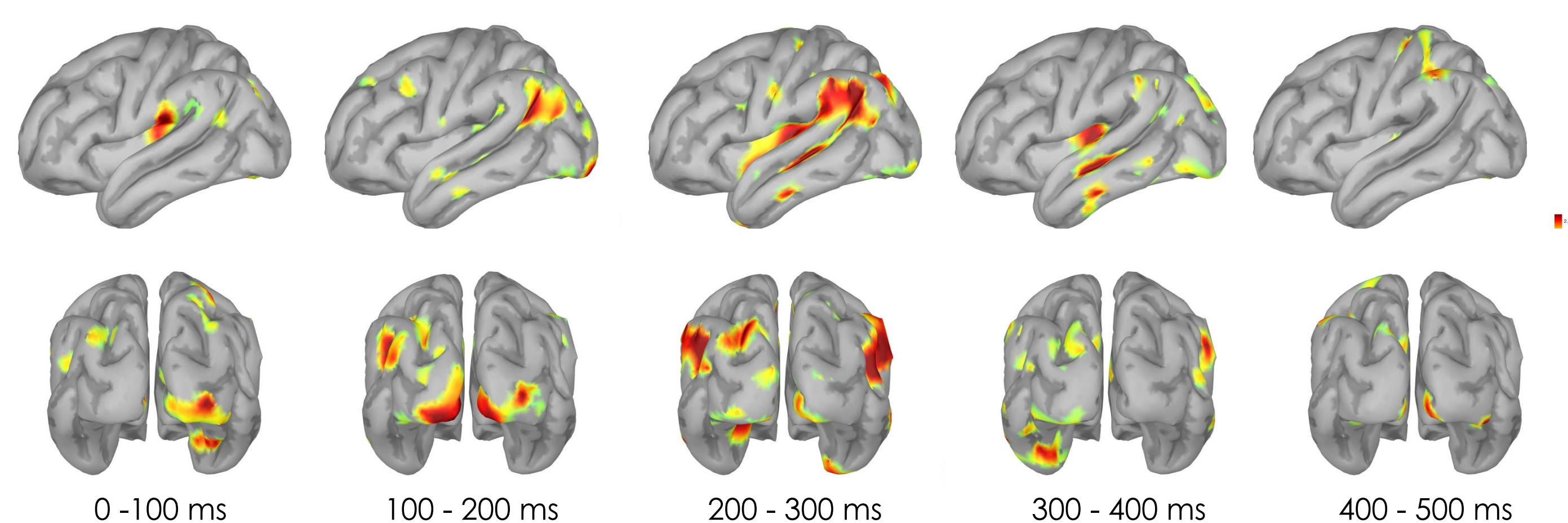
Word

Psw



400-500 ms

Norm [Zscore(Psw) - Zscore (Word)]



Conclusions

- MEG findings evidenced concurrent effects of lexicality in occipital and language-related areas of blind individuals.
- In sighted participants, only language related areas responded differently to words and pseudowords.
- These results seem to suggest that occipital cortex of congenitally blind individuals is involved in early lexical processing.

Van Ackeren, M. J., Barbero, F. M., Mattioni, S., Bottini, R., & Collignon, O. (2018). Neuronal populations in the occipital cortex of the blind synchronize to the temporal dynamics of speech. *Elife*, 7, e31640.

Bedny, M. (2017). Evidence from blindness for a cognitively pluripotent cortex. *Trends in cognitive sciences*, 21(9), 637-648.