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Attention and Consciousness Research Group

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INTERACTIONS BETWEEN EXECUTIVE ATTENTION AND CONSCIOUS PERCEPTION IN FUNCTIONAL CONNECTIVITY OF FRONTO-PARIETAL REGIONS

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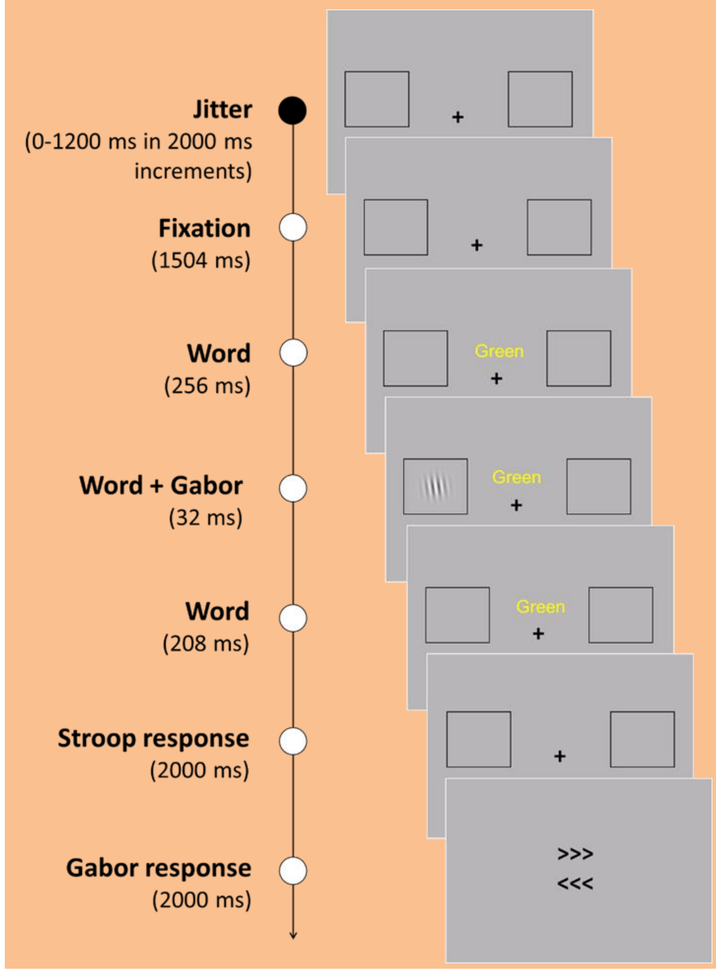
INTRODUCTION

- Attention is one of the most important mechanisms that allows the selection of information for conscious processing [1, 2].
- The executive control network is one of the three main attentional networks, which operates in situations that involve planning, novelty, error or conflict detection, and error or conflict resolution [3, 4].
- Executive control elicited by conflict situations influences decision stages of conscious processing [5].

Goals

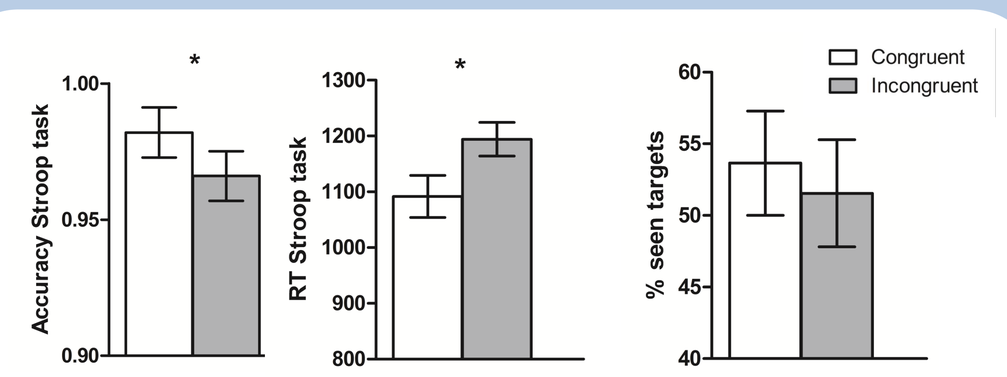
- To explore the neural interactions between conscious perception and executive control in the activation of fronto-parietal regions or in the functional connectivity among them.
- To explore the involvement of the Superior Longitudinal Fascicule (SLF, branches I and II) integrity in the behavioral and neural interactions between both processes.

METHODS

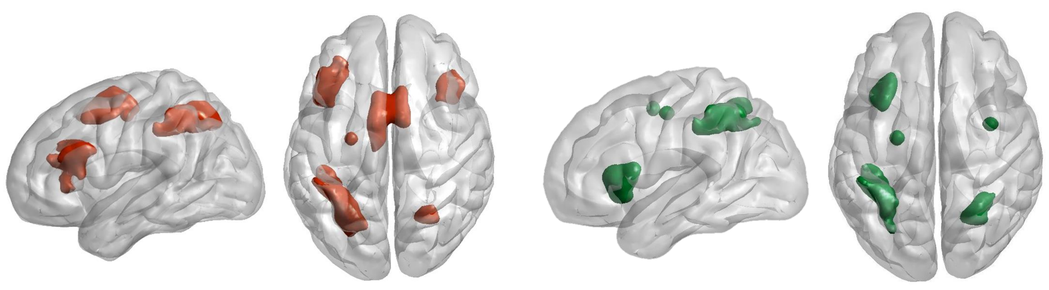


- 20 volunteers (11 females, mean age 24 years, SD= 3.34).
- Functional Magnetic Resonance Imaging (fMRI) while participants performed a Stroop task concurrently with a conscious detection task of near-threshold Gabor stimulus.
- *In vivo* dissections of the right and left SLF I and II using diffusion tensor imaging (DTI) tractography.

RESULTS

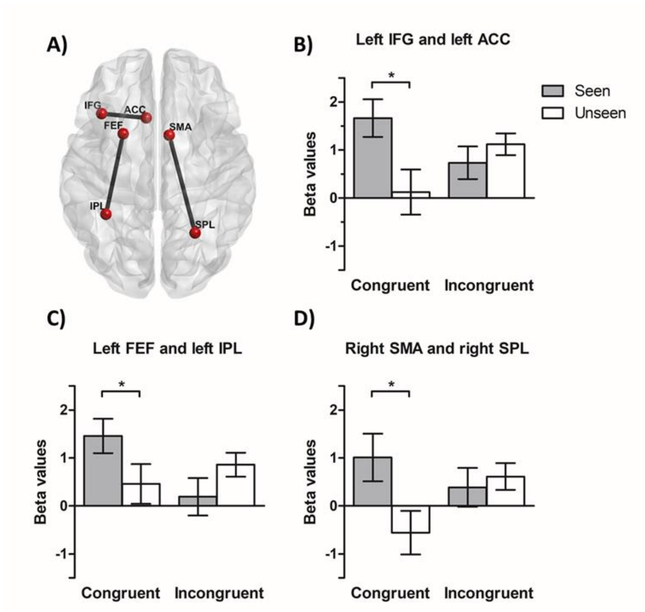


- A group of frontal and parietal regions demonstrated larger BOLD responses for the incongruent than the congruent condition (red) while another group of fronto-parietal regions demonstrated larger BOLD responses for seen than unseen Gabors (green) ($p < 0.05$, voxel-wise FDR corrected). No interaction between executive control and consciousness was found for any of the fronto-parietal regions examined.

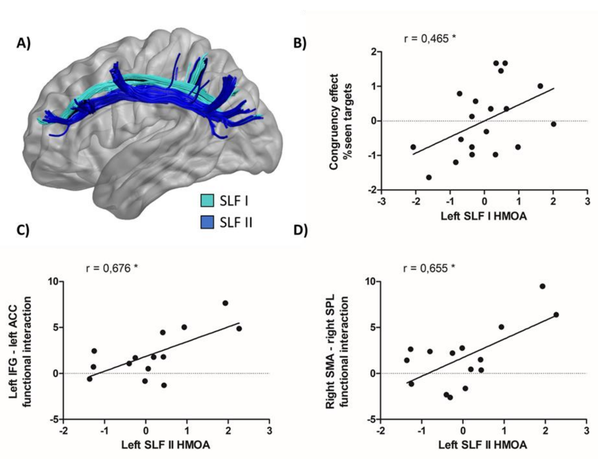


Congruency effect | Awareness effect

- An interaction between executive control and consciousness was found in the functional coupling of three fronto-parietal pairs of regions: left IFG-left ACC, left FEF-left IPL, and right SMA-right SPL.



- The integrity of the left SLF I was positively correlated with the behavioral index of the interaction between executive control and consciousness.
- The integrity of the left SLF II was positively correlated with the functional connectivity measures of the interaction between executive control and consciousness



DISCUSSION

Our data support the gateway hypothesis about the relationship between attention and consciousness [1, 2]. Executive control modulated the conscious perception of near-threshold stimuli, which, at the neural level, was reflected in the functional connectivity of fronto-parietal regions. DTI data highlighted the importance of the dorsal and middle branch of the SLF in the left hemisphere, demonstrating the importance of taking into account functional and structural connectivity for a more complete understanding of the cognitive system.

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