

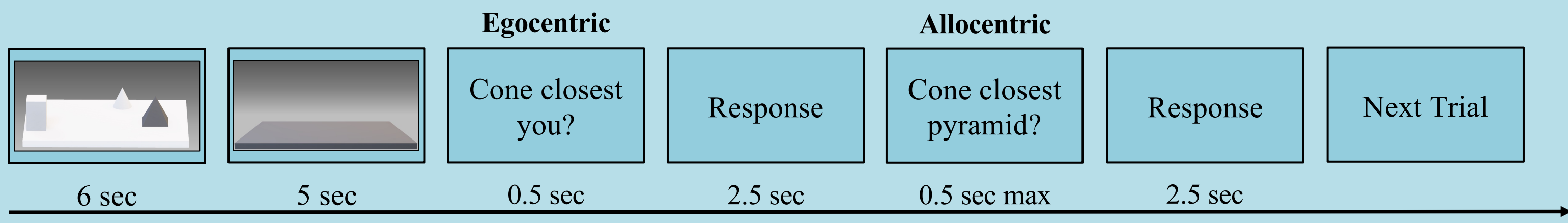
1. BACKGROUND

- Spatial information are represented in memory with respect to egocentric (body-to-object) and allocentric (object-to-object) frames of reference (FoRs). These spatial representations are respectively supported by fronto-parietal and medio/parieto-temporal regions (Galati et al., 2000; McNamara, 2002; Committeri et al., 2004; Zaehle et al., 2007; Chen et al., 2014; Ruotolo et al., 2018; Derby et al., 2021).
- To cope with the natural complexity of the surrounding environment, we constantly switch between egocentric and allocentric spatial representations. Such spatial switching process is supposed to be supported by posteromedial structures (PCC - RSC) and Locus Coeruleus Prefrontal Cortex Noradrenaline System (LCNA - PFC) (Burgess, 2006; Harris et al., 2012; Ruggiero et al., 2018).

3. METHOD

- Participants:** 38 (27 females) aged 18-35 (M = 22.86, SD = 4.08)
- Stimuli:** Ego-Allo Switching Task (Ruggiero et al., 2018)
- Procedure and Task:** participants were asked to memorize triads of 3D geometrical objects, then to provide two consecutive spatial judgments of relative distance about memorized stimuli in an egocentric (“object x closest you?”) and allocentric (“object x closest y?”) reference frames in switching (from Ego-to-Allo, from Allo-to-Ego) and non-switching (Ego-Ego, Allo-Allo) conditions.

- Experimental Flow:**

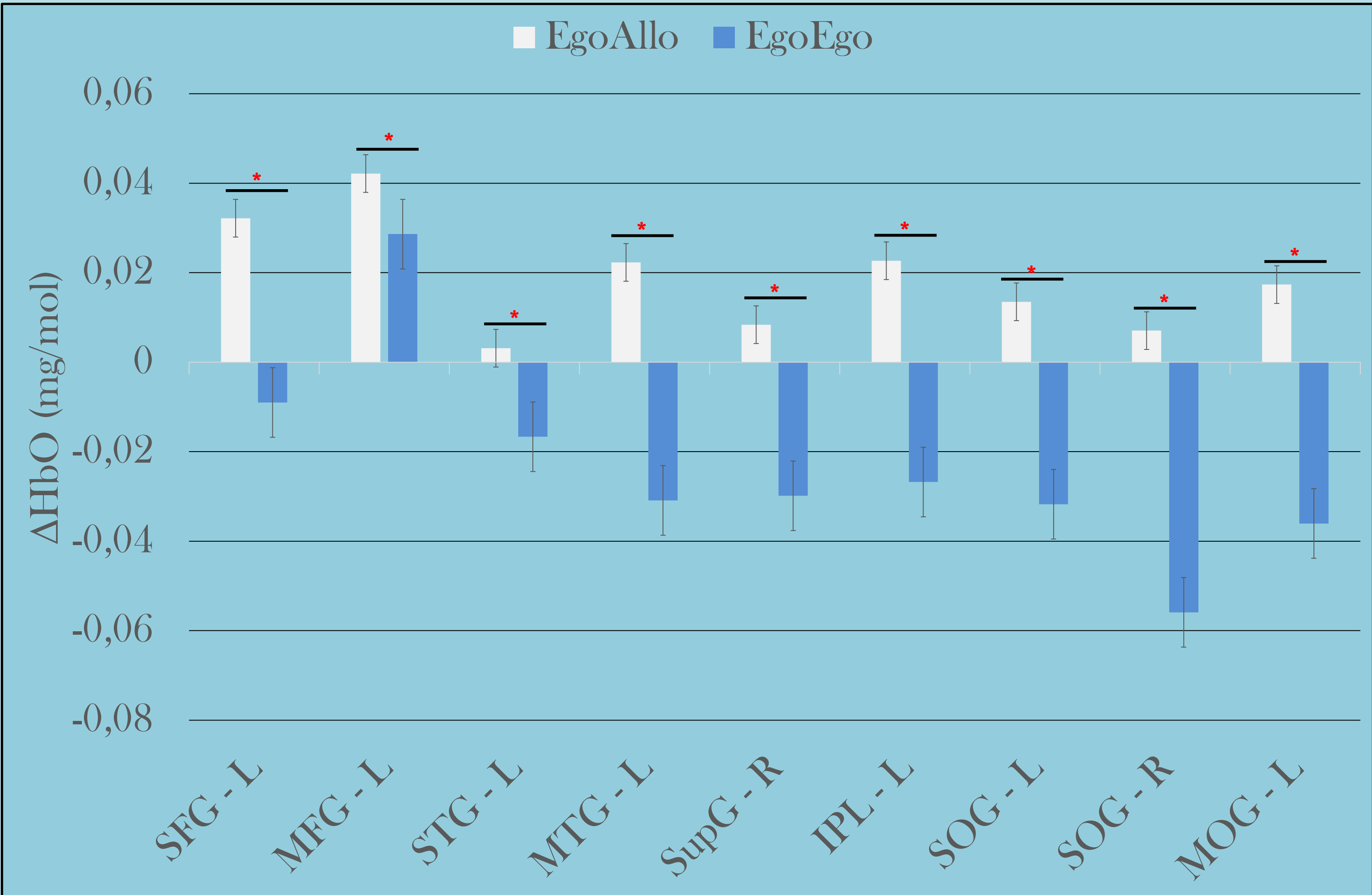


5. DATA ANALYSIS

The following one-tailed paired samples T-Tests were carried out on ΔHbO . False Discovery Rate method was used to control for multiple comparisons errors (Benjamini and Hochberg, 1995)

- Ego - Allo Vs Ego - Ego
- Ego - Ego Vs Ego - Allo
- Allo - Ego Vs Allo - Allo
- Allo - Allo Vs Allo - Ego

6. RESULTS



LEGEND

SFG= Superior Frontal Gyrus; MFG= Middle Frontal Gyrus; PreG= Precentral Gyrus; PosG= Postcentral Gyrus; STG= Superior Temporal Gyrus; MTG= Middle Temporal Gyrus; SupG= Supramarginal Gyrus; SPL= Superior Parietal Lobule; IPL= Inferior Parietal Lobule; SOG= Superior Occipital Gyrus; MOG= Middle Occipital Gyrus.

Significant increase in ΔHbO was found in frontal regions and in the Temporo-Parietal Junction (i.e., including the Supramarginal and Middle Temporal gyri), for Switching (Ego-Allo and Allo-Ego) vs Non-switching (Ego-Ego, and Allo-Allo) conditions. Furthermore, significant increases in ΔHbO were found in frontal regions only for allocentric-based Non-Switching (Allo-Allo) vs Switching (Allo-Ego) conditions.

7. CONCLUSIONS

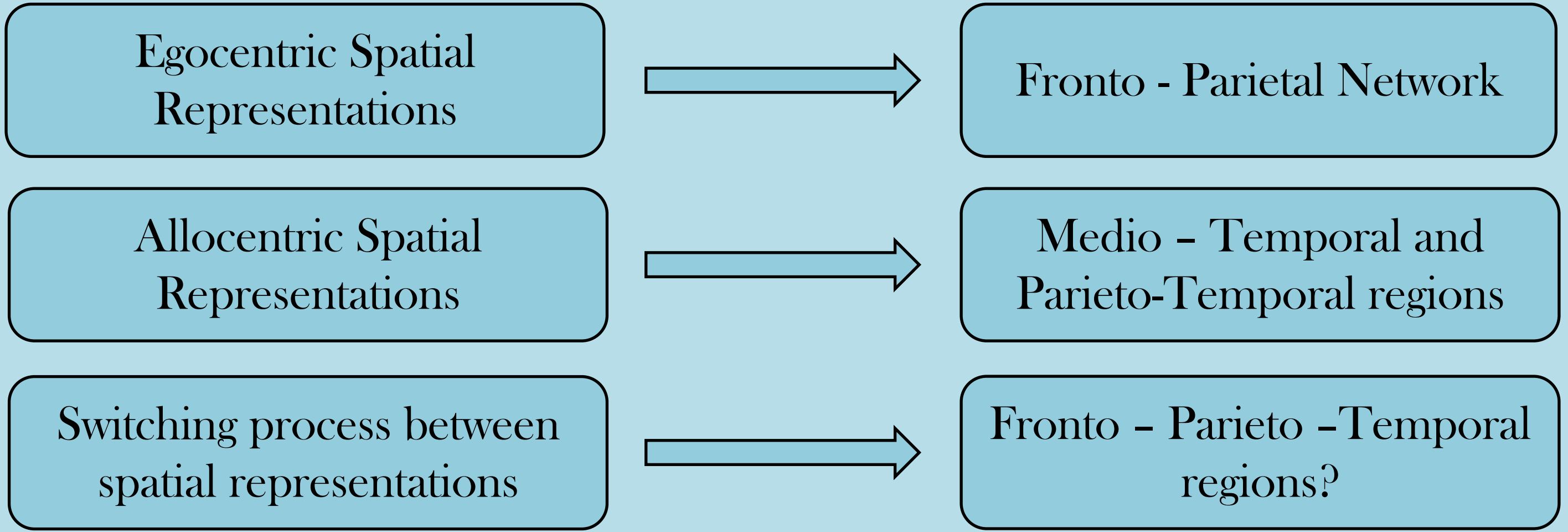
The results have shown that allocentric-based non-switching spatial processes relied more on frontal regions due to the effort needed to detach from the natural egocentric perspective (Iachini & Logie, 2003). Moreover, the involvement of frontal regions has been found also in the transition from ego-to-allo spatial representations and, interestingly, the cortical activation subserving switching processes between reference frames spread out also towards parieto-temporal regions. Overall, the switching process between reference frames was supported by a fronto-parieto-temporal network. **These results are in line with the third-stream hypothesis (Rizzolatti & Matelli, 2003) since a selective involvement of the “ventro-dorsal stream” was observed during the switching from an egocentric to an allocentric reference frame.**

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2. RESEARCH QUESTION

Despite such visuo-spatial process is pivotal in our daily life activities, to date it is unclear which cortical regions are mainly involved in spatial switching processes.



4. fNIRS DATA ACQUISITION

Oxygenated (ΔHbO), and Deoxygenated (ΔHbR) haemoglobin concentrations were recorded by Shimadzu FOIRE-3000 apparatus through two source-detectors probes design covering (a) Fronto-Parietal (b) and Occipito-Temporal brain regions (see figures below).

