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Exploring Neural Dynamics in Mental Rotation Through Time-Resolved Transcranial Magnetic Stimulation

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Mental rotation (MR) is a crucial process that underlies our ability to spatially navigate and recognize objects despite viewing them from varying distances and viewpoints. MR competence is linked to superior sport and academic performance, and deficits can impact daily activities like driving. Previous work using single-pulse TMS has confirmed the causal involvement of left and right dorsal premotor area (PMd) and left superior parietal lobe (LSPL) in MR performance. In the present study, we aimed to identify critical time windows during which these regions are essential for task performance. 30 healthy right-handed young adults received suprathreshold single-pulse TMS to PMd and LSPL during a mental rotation task, at 100, 200, 300 and 400 ms after stimulus presentation. TMS-induced disruption is expected to delay response times, highlighting the temporal dynamics of perceptual-motor decision processes. Preliminary results reveal that TMS to left PMD at 100 and 200 ms, slowed response times on the task relative to Vertex, suggesting that left PMd contributes to early stages of visuospatial transformation. Since left PMd affects right-sided movement , further investigations are underway replicating this experiment in a new right-handed cohort performing the same task with a left-handed response. Replicating our findings would confirm the specific causal involvement of left PMd in mental rotation.

Primary author: GOYAL, Ishita (Universitätsklinikum Würzburg)

Co-authors: Dr HIEW, Shawn (Universität Bern); Dr GREENWELL, Davin (Universitätsklinikum Würzburg); Dr ZELLER, Daniel (Universitätsklinikum Würzburg)

Presenter: GOYAL, Ishita (Universitätsklinikum Würzburg)

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