MODULATING EPISODIC MEMORY THROUGH EGOCENTRIC NAVIGATIONAL TRAINING (MEMENT): BEHAVIOURAL STUDIES

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Background: Based on the observation that the neuronal algorithms underlying navigation in real and mental space are fundamentally the same, Moser and colleagues (2013) proposed a phylogenetic continuity from navigation to declarative memory: sophisticated mechanisms of episodic memory (EM) and semantic memory (SM) would have evolved from basic mechanisms of egocentric navigation (EN, like path integration: PI) and allocentric map-based navigation, respectively. Initial data from our group found a positive and selective correlation between EN and EM.

Aims: 1) Replicating our findings by controlling for the effect of unspecific cognitive abilities; 2) developing an EN training based on PI and new dynamic EN, EM and SM tasks, with parallel versions to allow repeated assessments over time 3) testing the causal relationship between EN and EM through EN training.

Method: We tested EN and EM on 30 subjects by using classical tasks of proprioceptive PI (pTCT) and item recognition. We assessed SM with a verbal questionnaire. We controlled for the effect of working memory and attention, and we also tested the degree of domain independence by including a visual PI (vTCT) task and a non-verbal SM task. We then developed an EN training based on pTCT and a set of parallel versions of new dynamic tasks: for EN, a Google based "Travel in Space" task (TS); for EM, a film-based "Travel in Time" task (TT); for SM, a "Travel in Categories" task (TC); and a film-based short-term memory task (STM).
In two experiments on healthy young volunteers, we examined the effect of the EN training (Experimental group, N = 25) vs. a visual perceptual training (Control group, N = 26) on memory (TT, TC, STM).

Preliminary results: We replicated our previous results indicating a positive correlation between EN (pTCT) and EM ($p < 0.001$), but not between EN and SM. This correlation remained significant when controlling for other cognitive abilities ($p < 0.05$), and when using the vTCT and the non-verbal SM task (Committeri et al., 2020). We confirmed these results with the new developed tasks: TS positively correlated with TT ($p < 0.01$), while the relationship with TC was spurious and indirect (Fragueiro at al., 2021).
Finally, we observed a significant effect of training in the experimental group ($F_{(1,24)}$ = 20.012, $p < 0.001$), and post-hoc tests evidenced that the improvement in memory was specific for TT task ($F_{(1,24)}$ = 23.491, $p < 0.001$). In contrast, no significant effect of training has been observed in the control group.

Keywords: Egocentric navigation; Path integration; Episodic memory; Semantic memory

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