

Between Zero and one: Evidence for an Analog Cognitive Computation in the Re-Planning of Movements

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Presentation Abstract Summary When humans make similarity judgments about two rotated objects, reaction time (RT) is linearly predicted by the objects' relative degree of rotation — suggesting a kind of “analog” rotation of a mental percept (Shepard & Metzler, 1971). Evidence for such analog computations has been indirect, in the form of RT measures in psychophysical tasks or modulations of BOLD signals in fMRI. Here, we set out to find direct evidence of a form of mental rotation in a reaching task that allows for the possibility of intermediate computations to be observed – a more critical test of an analog-like computation. Subjects mentally rotated an intended reach direction relative to a target in a forced response time task, which often forced them to move prior to completing the mental rotation of their movement vector. Under these conditions, subjects executed predictable movements directed at intermediate locations between the target and goal. This result supports a critical prediction of analog cognitive computations, showing that mental rotation does indeed proceed smoothly through intermediate states, as hypothesized by Shepard (1971). Furthermore, these results suggest that a mental rotation-like operation drives volitional re-planning of reaching movements via a continuous sweep through a mental representation of directional space.

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