## Planning and serial reasoning in premotor cortex

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Planning is the cognitive function underlying our ability to organize, for example, the motor output needed to achieve a future goal such as making a sandwich. The premotor cortex (PMC) with its integrative features is a key component of the brain network underpinning this function. Indeed, PMC has an active role in sensory-motor associations and in the compositional computation giving rise to a goal-directed sequence of actions.

Here I will discuss how the collective dynamics of PMC in monkeys unfolds to encode the plan to move and how unpredictable events leading to stop movement initiation are processed. I will focus on the mechanistic underpinnings responsible for the metastable dynamics resulting from the coordinated activity of heterogeneous cell assemblies.

Starting from the capability of PMC to process multiple competing sensory information and transform them into appropriate motor decisions, I will speculate on the possible role of this area in serial reasoning. Indeed, ordering arbitrary stimuli and actions as a sequence is a critical computational skill for planning. Thinking for instance to the aforementioned sandwich, after having taken the bread and cut it, it must eventually be stuffed before it is ready to be eaten.

To this purpose I will refer to the transitive inference task, where a subject knowing that A > B and B > C must infer that the item A has a higher rank than C (A > C). Finally, I will provide evidence that PMC is directly involved in solving this task by showing a neuronal correlate of the mental line in which the presented items are ordered. This in agreement with a theoretical expectation that the mental line results from a simple geometric computation.