



Covert strategies determine the preservation of neural population dynamics across individuals during a cognitive task

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The coordinated activity of neural populations—their latent dynamics— within motor regions of the brain is preserved across individuals from the same species performing a similar behaviour (Safaie, Chang et al. [1]). Such preservation is linked to behavioural similarity and presumably reflects the shared connectivity patterns of their neural circuits. Here we asked whether a cognitive task that can be solved using different covert strategies would reveal latent dynamics whose preservation is linked to the similarity in the strategies themselves.

We analysed prefrontal cortex recordings from an associative memory task in which monkeys had to select the target associated with an initial visual cue, following a working memory period in which no information was presented (Tremblay et al. [2]). We computed session-specific latent dynamics using Principal Component Analysis and defined the covert “strategy” based on the evolving relationship of the latent dynamics with the past cue and the future selected target during the memory period. We tested the preservation of latent dynamics across individuals using Canonical Correlation Analysis.

Animals solved this task using different “strategies” which clustered into distinct groups. Using this classification, we found that both the preservation of latent dynamics and the ability to decode future target across animals were associated to the similarity of their covert strategies. Moreover, monkeys exhibited idiosyncratic fidgets during the working memory period that were predictive of the future selected target. These fidgets had a stable relationship with the prefrontal cortex latent dynamics and largely drove their across animals. Neural population dynamics thus capture fundamental differences and similarities in neural processes across individuals during both sensorimotor and cognitive processes.

neural dynamics, neural population, working memory, prefrontal cortex, embodiment

