Perceptual Decision Making Unfolds in a Processing Cascade Within and Across Brain Regions

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Presentation Abstract Summary Perceptual decision making is proposed to consist of a sequence of processing stages. However, the neural computations involved at each stage mainly derive from spatially limited electrophysiology recordings or temporally unresolved functional Magnetic Resonance Imaging (fMRI). To shed light on these limitations, we apply linear multivariate pattern analyses (MVPA) to spatiotemporally resolved magneto-encephalography recordings (MEG). Seventeen participants discriminated between ambiguous visual symbols, constructed from 8-step morphs of letter/digit pairs. Stimulus features associated with each stage were orthogonalised by design: stimulus contrast (sensory), stimulus identity (evidence accumulation), stimulus ambiguity (difficulty) and response button (motor). Our results show that each of these variables can be sequentially decoded from the MEG signals generated by the visual, parietal and motor cortices respectively, and continue to be maintained in parallel thereafter. Importantly, the specific pattern of neural activity elicited by each variable continuously changed over time. Unlike discrete stage models, our results suggest that each stage is best accounted for by a cascade of neural computations within and across regions. These findings extend the results of previous studies and provide a macroscopic description of the elementary computations involved in perceptual decision making.

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