

Title: Rotational remapping between “decision-potent” and “decision-null” representations in visual working memory

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In previous work, we trained a 3-layer fully-recurrent neural network (RNN) to perform a 2-back task to study the transitions in stimulus representation as an item (n) transitioned from memory probe (for comparison vs. $n - 2$) to unprioritized memory item (UMI; while $n + 1$ was compared to $n - 1$), and then to prioritized memory item (PMI; for comparison with $n + 2$). We tracked stimulus representation by projecting activity patterns of the hidden layer into a 2D space with Principal Component Analysis (PCA). These simulations revealed a decision axis, whereby, on trials requiring a “match” response, representations of n clustered along a manifold in the center of this 2D space, and on “nonmatch” trials, representations of n clustered in one of two discrete clouds that flanked the “match” manifold. While a UMI, the representation of item n rotated to an axis orthogonal to the decision axis, and when a PMI it rotated into alignment with the decision axis. In this study, to see whether the brain implements a similar mechanism, we conducted PCA on EEG data recorded while subjects performed 2-back for oriented gratings. Consistent with RNN results, the EEG representation of n when a UMI was rotated by 177° relative to when a PMI. Moreover, this PMI representation closely resembled the delay-period representational structure of the same stimuli when tested with a 1-item delayed recognition task. Priority in working memory may be implemented by representing information in decision-potent versus decision-null formats.