**Tracking item representations during free recall**

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**Introduction**

Context-based theories of memory posit that items on a studied list become associated with the mental context in which they are experienced. We present a framework for tracking the neural correlates of individual items and the contexts in which they are experienced, during individual presentation or recall events.

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**Context-based theories of memory**. Context drifts gradually over time and becomes associated with each experienced event, giving rise to the contiguity effect in free recall. Our approach allows us to decode semantic information from neural patterns. This will allow us to examine the extent to which the evolving neural representation of context contains semantic information.

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**Overview**. We measure the BOLD response evoked by each presented word during the experiment. We use Latent Dirichlet Allocation, a topic modeling algorithm, to compute topic vectors for each word in a large vocabulary. Using the known topic vectors for each of the presented words, our goal is to infer the neural representations of each topic. Then we use the inferred topic representations to decode topic vectors from previously unseen neural patterns.

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**Training**

**Memory experiment**

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**Experimental methods**. Participants in an fMRI scanner view 60 words, repeated 3 times each. Then they study and freely recall 12-item lists of the same words.

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**Training**: \( \hat{\theta}_t(k) = \sum_{i=1}^{T} \theta_i(k) Y_i \)

**Test**: \( \hat{\theta}_t(k) \propto \text{corr}(Y_i, \beta_k) \)

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**Results**. The top panel shows our ability to decode individual topics from training phase data (inset: synthetic noisy data). The bottom panels show decoding of memory experiment data.