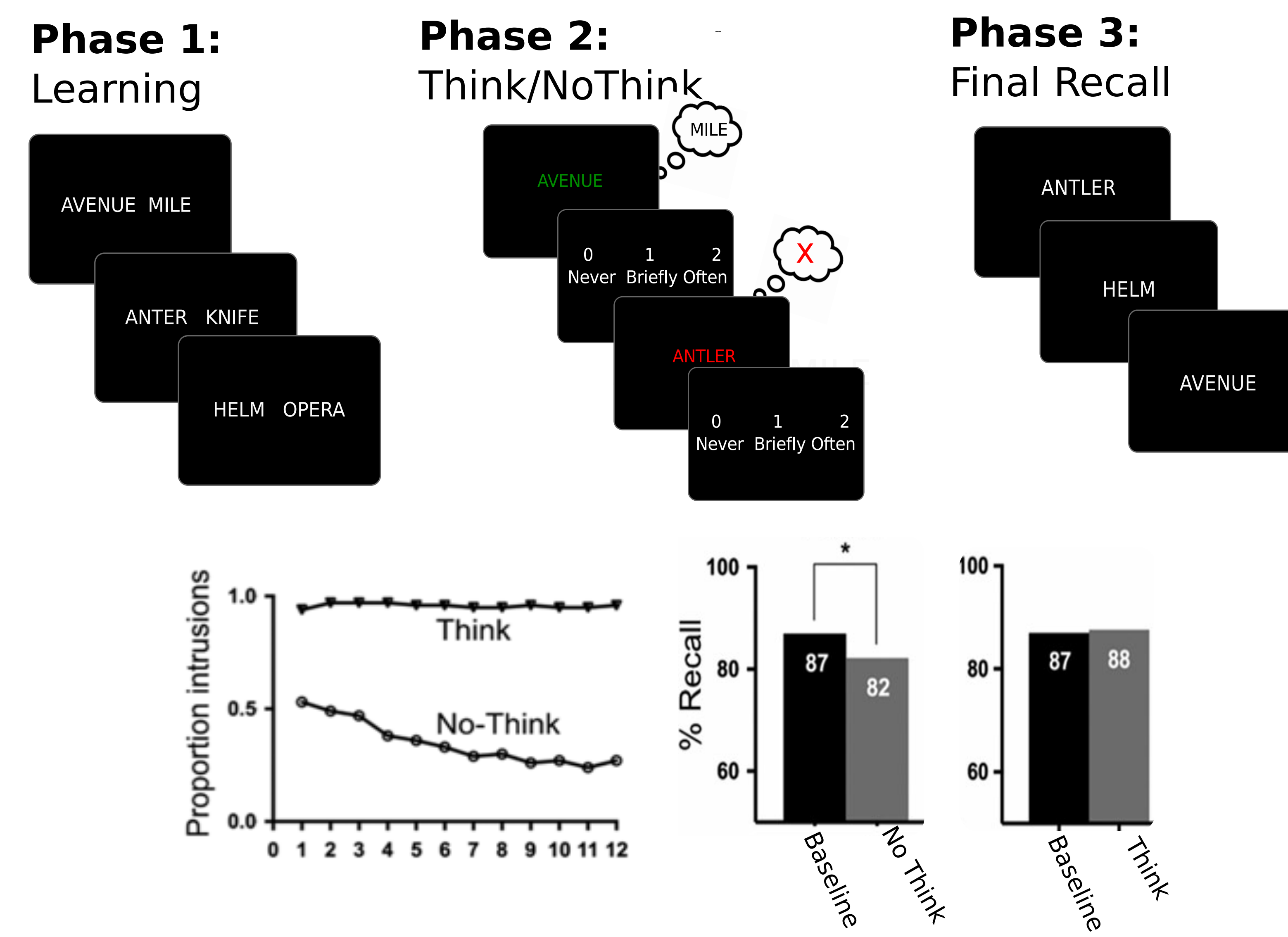


Introduction

- Cues in the environment can elicit retrieval of unwanted memories
- A major question in cognitive psychology is whether/how we are able to voluntarily "cancel" cued retrieval
- The Think/NoThink (TNT) task(1) was designed to probe this question and to test theories of executive control over retrieval
- In TNT, participants learn associations between multiple word pairs. They are then given a memory cue (i.e. the left word from a pair) and instructed to either "think" of the associate or to try to prevent retrieval and "not think" of the associate.
- Recent task versions(3) ask participants to report "intrusions" after each trial (i.e. indicate whether or not the associate came to mind)
- Self-reported intrusions may be susceptible to demand characteristics and they do not provide any temporal information about when memories intrude during a NoThink trial
- We aim to develop a more objective method for determining when people are successful in "stopping" cued retrieval

The Standard Think/No Think Task



Common "NoThink" Behavioral Effects (e.g. 1,2,3):

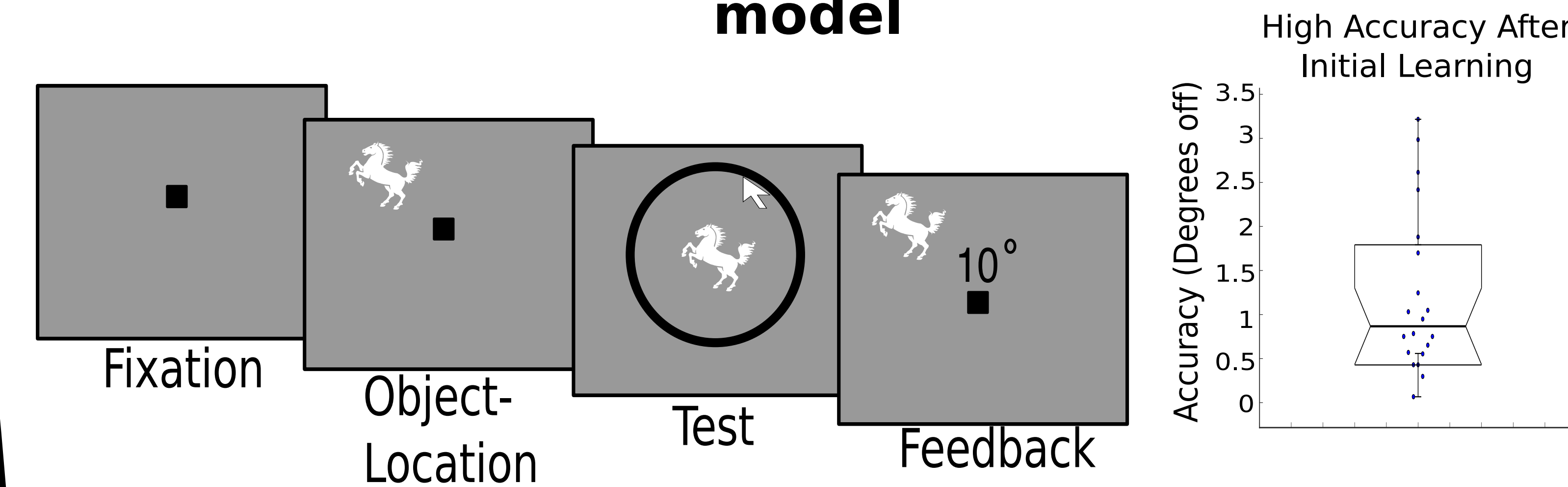
- Decline in the frequency of intrusions on NoThink trials across task duration
- Impaired final recall for NoThink pairs

Inverted Encoding Model (IEM) Approach

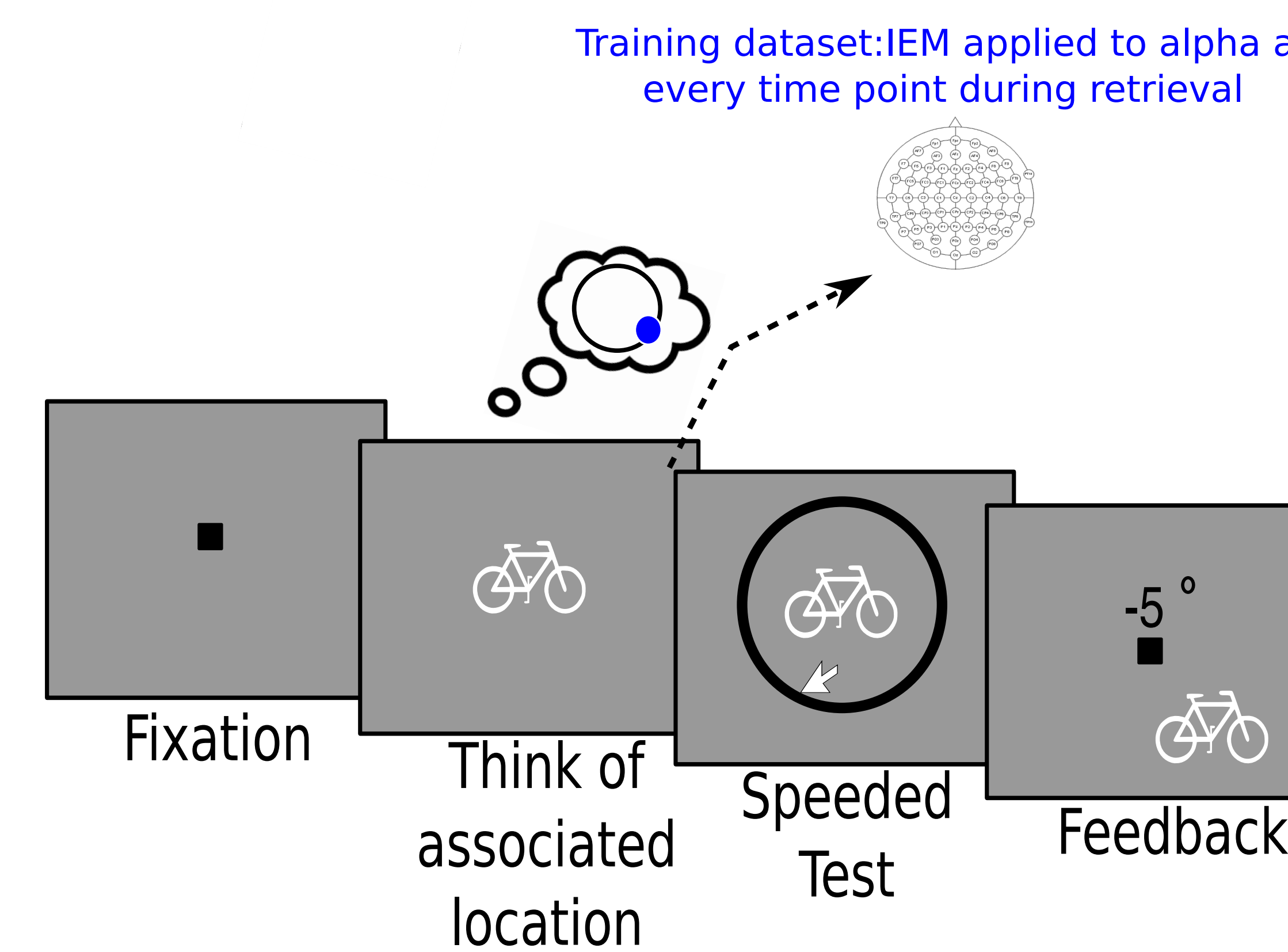
- IEMs use multivariate patterns of neural activity (e.g. EEG) to reconstruct specific stimulus information (i.e. orientation, spatial location, etc.).
- An IEM applied to alpha oscillatory power can track the retrieval of precise spatial memories from long term memory(4).
- We designed a spatial memory version of TNT using object-location associations.
- We applied an IEM to alpha power in scalp EEG data to test whether we could track retrieval of spatial memories on Think trials and to test for an erosion of reconstructions on NoThink trials as participants try to prevent retrieval.

Applying IEM to a Spatial Memory Version of TNT

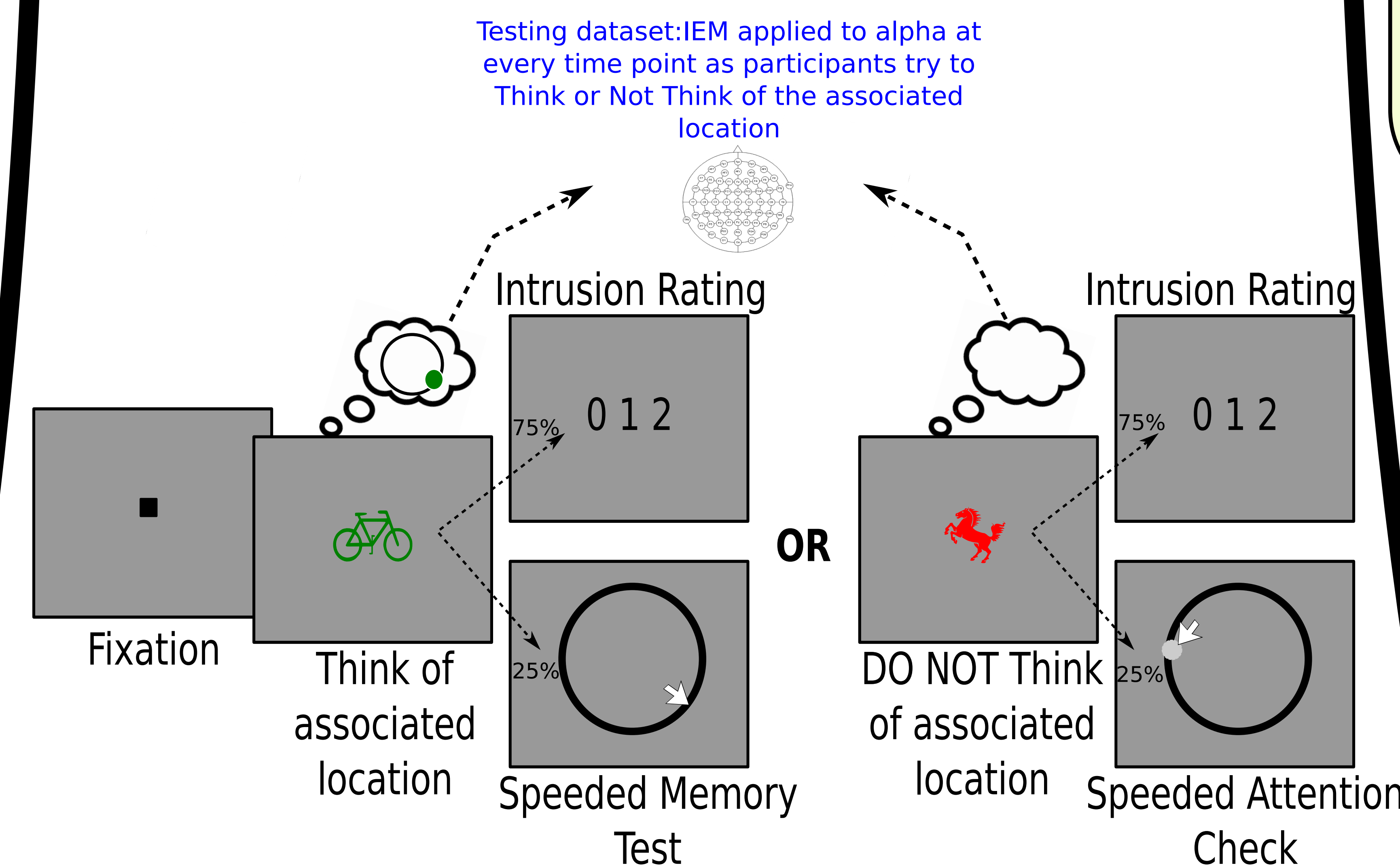
Phase1 Part1: Learning object-location associations (12 total) prior to training the model



Phase1 Part2 (Training Dataset for IEM): EEG collected during active retrieval of each object-location

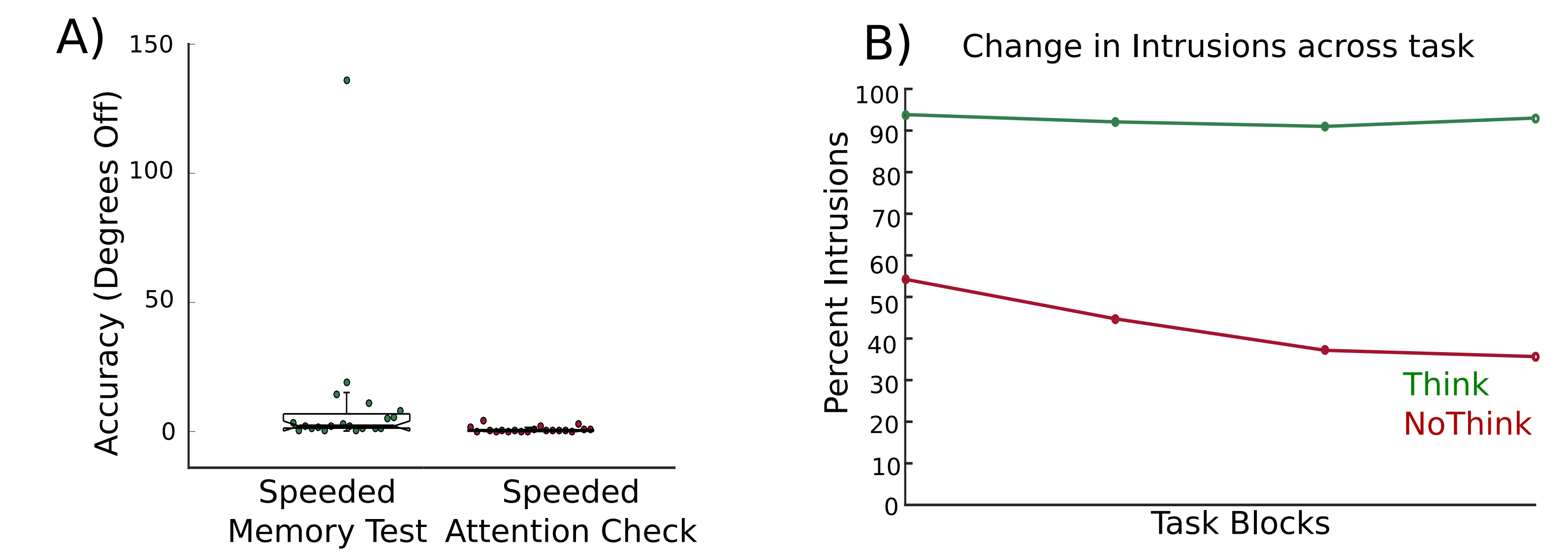


Phase2 (Testing Dataset for IEM): EEG collected during Think/NoThink



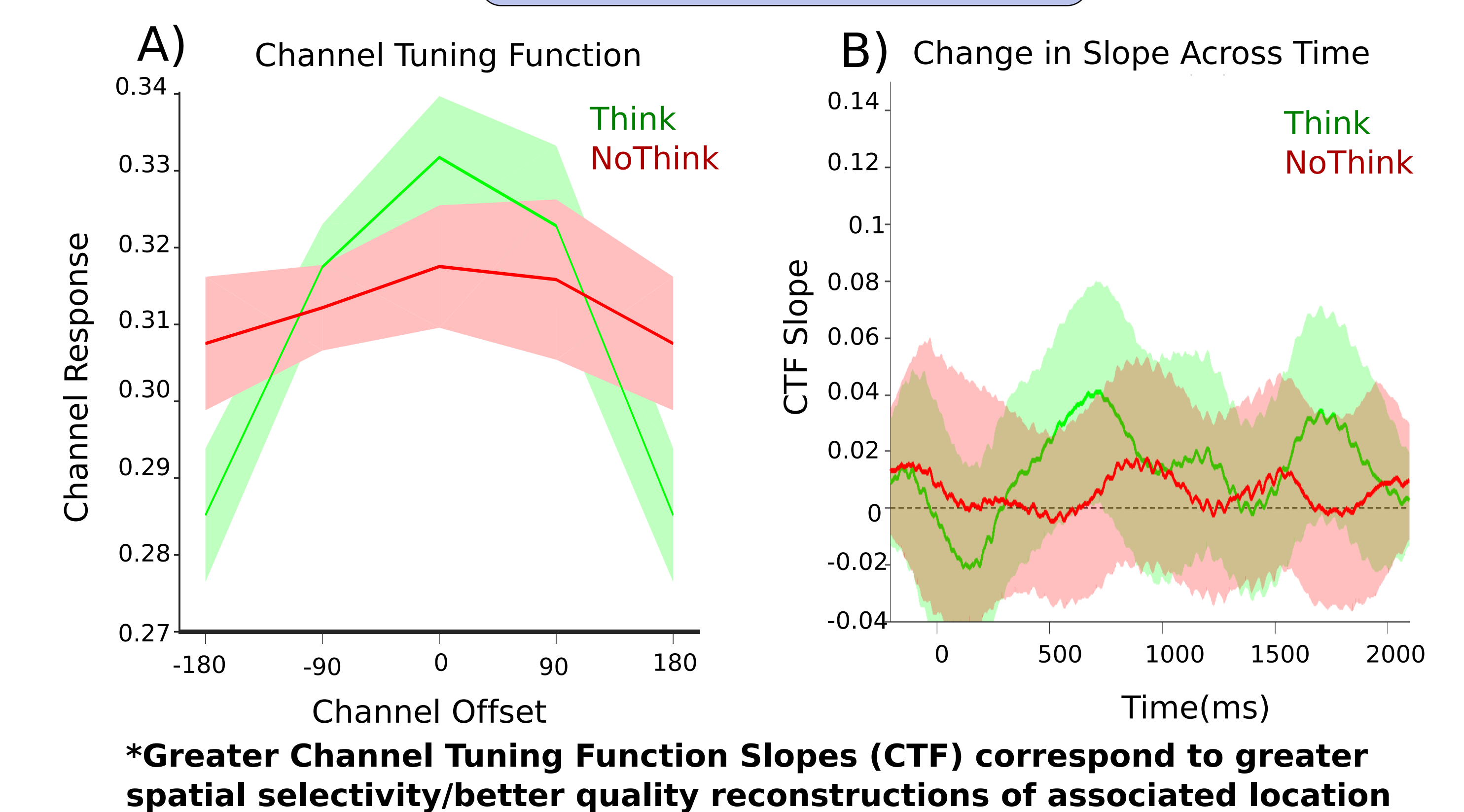
Intrusion ratings: indicate if the associated location came to mind
0=never, 1=briefly, 2=often
Speeded Memory Test (only on Think trials): 1sec to click the remembered location
Speeded Attention Check (only on NoThink trials): 1sec to click the dot that appears

Behavioral Results



- High accuracy in both speeded memory test (post Think trials) and speeded attention check (post NoThink trials)
- Typical decrease in reported intrusions on NoThink trials across task duration

IEM Results



- Reliable reconstructions of retrieved spatial memories in Think (CTF slope > 0); Eroded reconstructions in NoThink (CTF slope = 0); No significant difference between Think and NoThink.
- Quality of reconstructions across time shows large variation in data; Timing of reliable reconstructions in Think (slope > 0) consistent with data on long term retrieval(5) (~500ms post cue).

Conclusions

- IEM approach provides more objective and specific metric for tracking retrieval in a Think/NoThink Task
- Reliable reconstructions of retrieved spatial memories on Think trials helps to validate this approach
- Erosion of reconstructions in NoThink suggests that participants were largely successful in preventing retrieval but there was not a reliable difference between conditions
- No difference between conditions may be, at least in part, because NoThink trials include mix of successful and failed (i.e. trials with an intrusion) trials and timing of intrusions may vary widely across trials

Key References

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