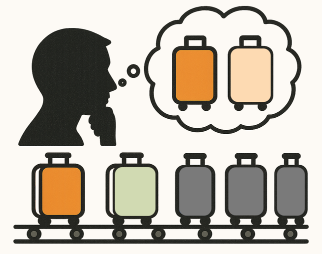
# EEG decoding reveals a link between visual working memory fidelity and the magnitude of similarity-induced memory bias

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## Background



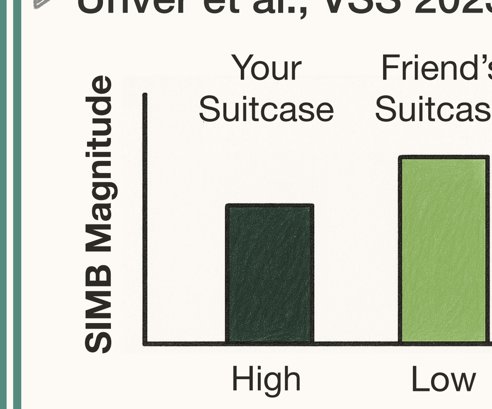
Visual working memory (VWM) reports can be **biased toward** novel visual input when VWM is **judged as similar** to input.

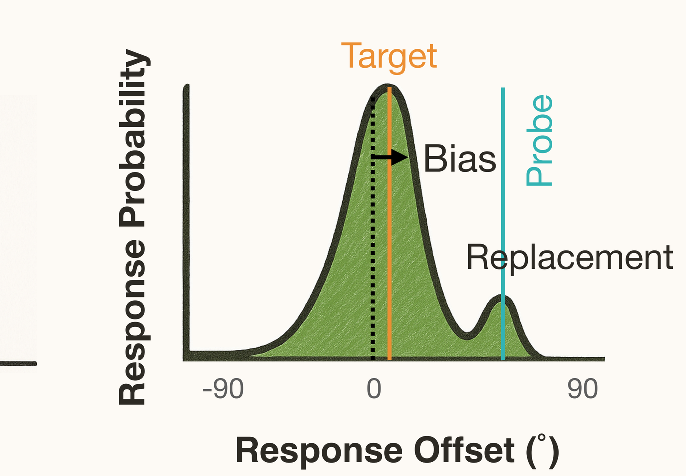
Similarity-induced Memory Bias *a.k.a.* SIMB.

**How does target strength relate to SIMB?**

## Hypotheses

- Ünver et al., VSS 2023

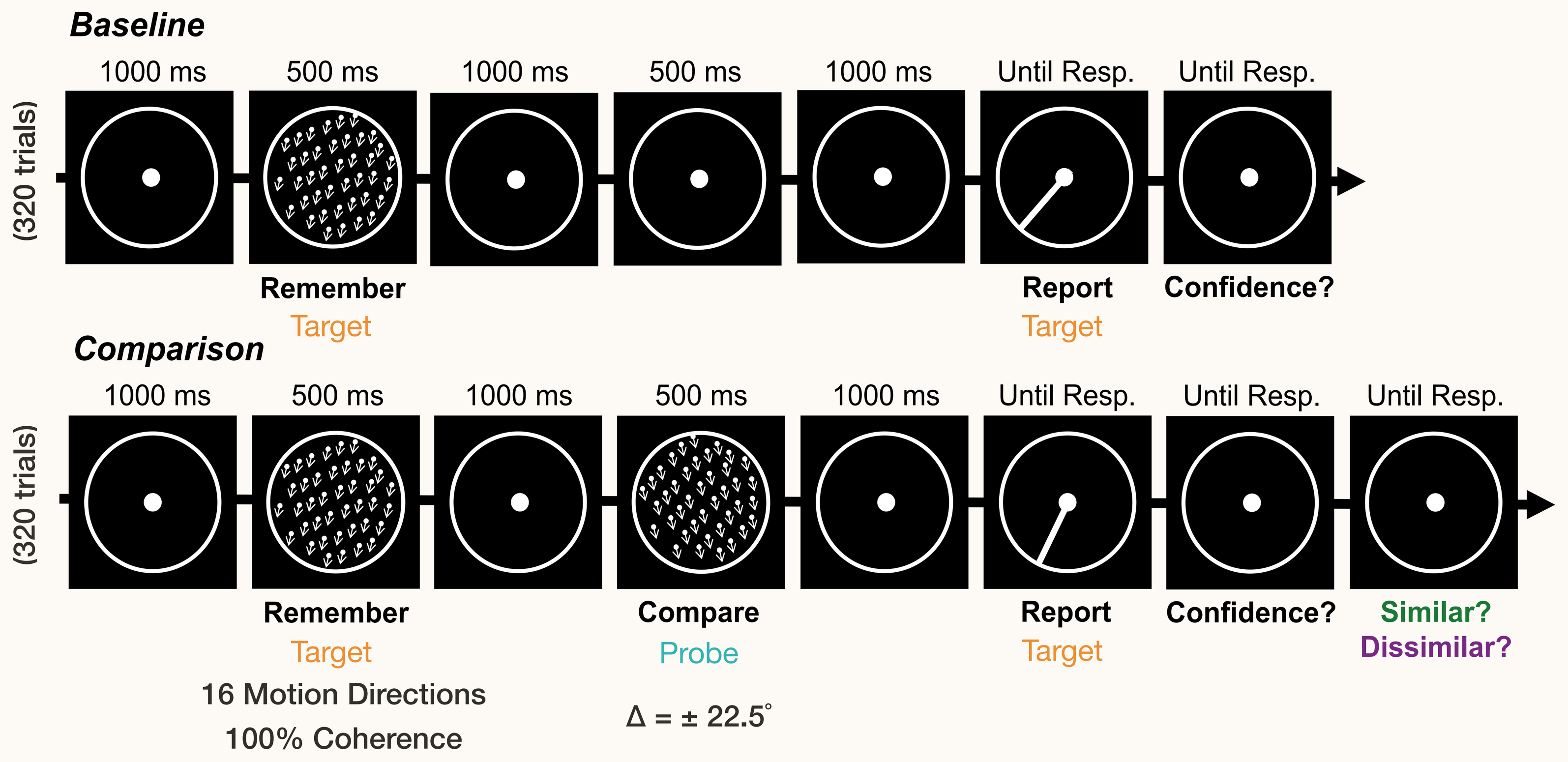

SIMB Magnitude
Your Suitcase
Friend's Suitcase
High
Low
Stimulus Certainty


Target
Bias
Probe
Replacement
Response Probability
-90
0
90
Response Offset (˚)

- **Encoding Weakness Hypothesis:** SIMB stronger when the target is weakly encoded.
- **Probe Interference Hypothesis:** SIMB stronger when probe is more strongly encoded.

## Method

### Procedure


Baseline
(320 trials)
1000 ms
500 ms
1000 ms
500 ms
1000 ms
Until Resp.
Until Resp.
Remember Target
Report Target
Confidence?
Comparison
(320 trials)
1000 ms
500 ms
1000 ms
500 ms
1000 ms
Until Resp.
Until Resp.
Until Resp.
Remember Target
Compare Probe
Report Target
Confidence?
Similar? Dissimilar?
16 Motion Directions
100% Coherence
Δ = ± 22.5˚

### Participants

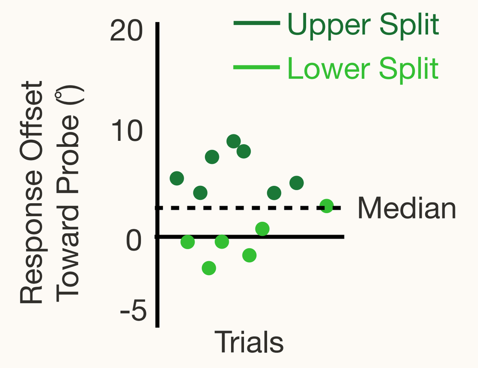
N=23

Participants with ≥ 80 similar trials (N=19)

Participants with ≥ 80 dissimilar trials (N=17)

### Trial-wise Median Split

For each participant and target bin:

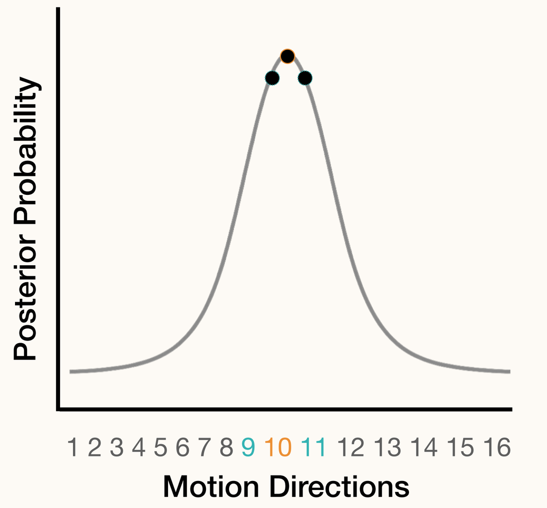

Upper Split
Lower Split
Median
Response Offset Toward Probe (˚)
Trials

### EEG Analyses

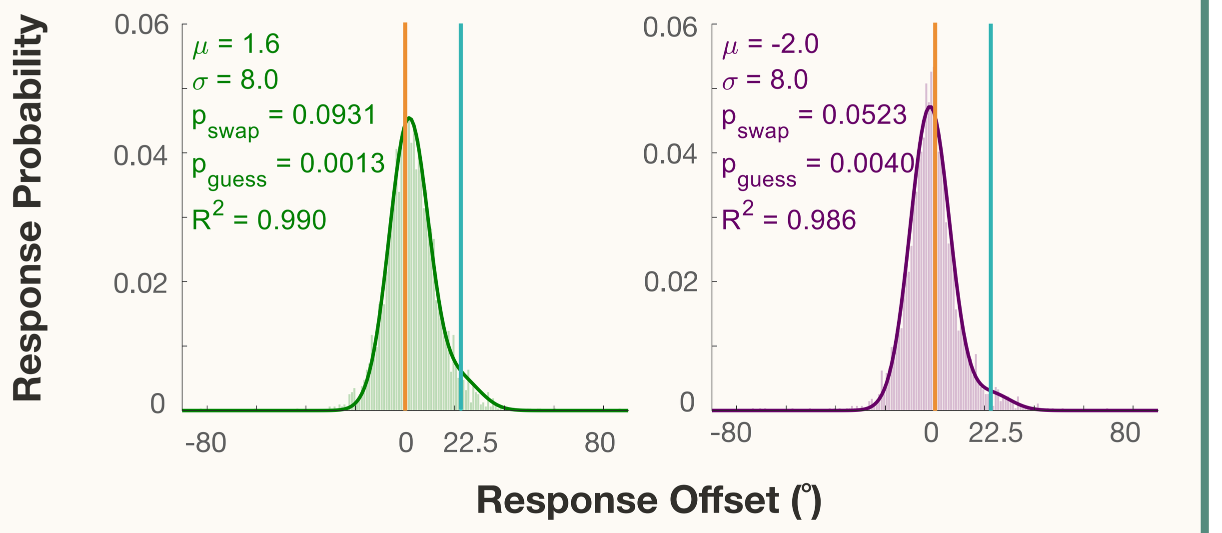
Decoding motion direction from posterior EEG channels

Trial-by-trial, within time point

Output = probability of the direction being the target


Posterior Probability
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Motion Directions

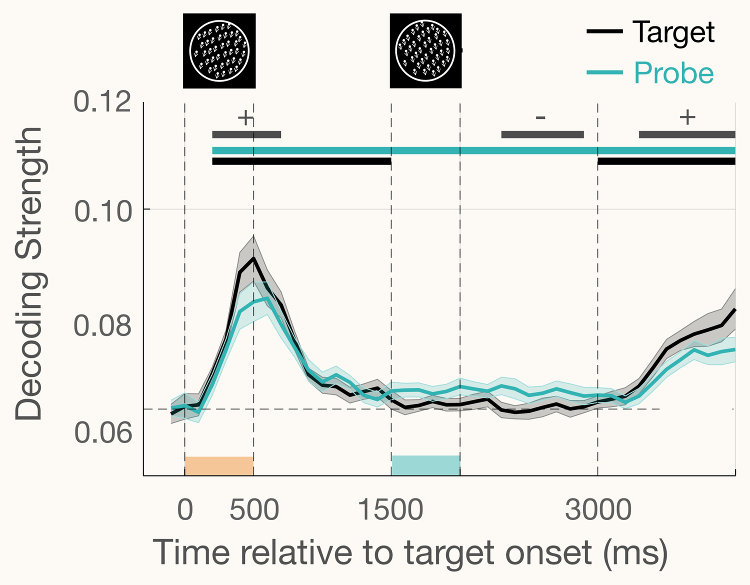
## Behavioral Results


Response Probability
μ = 1.6
σ = 8.0
p swap = 0.0931
p guess = 0.0013
R² = 0.990
μ = -2.0
σ = 8.0
p swap = 0.0523
p guess = 0.0040
R² = 0.986
Response Offset (˚)

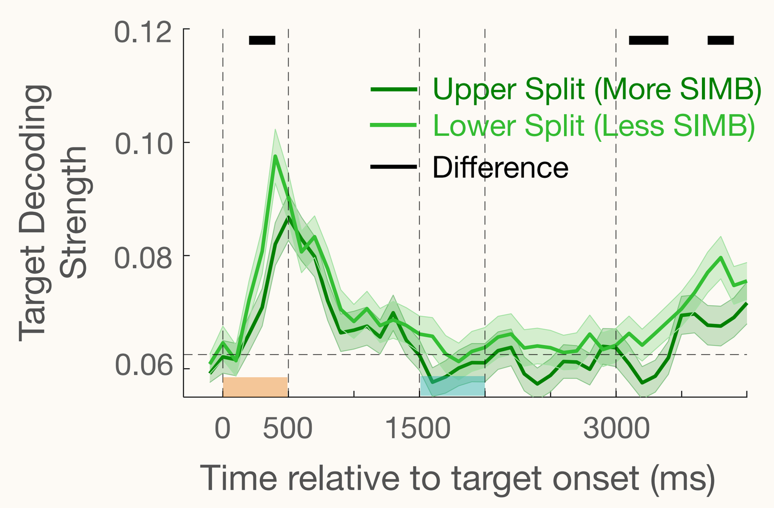
Response offset shows **attraction toward similar** and **repulsion away from dissimilar** probe together with **replacement** errors!

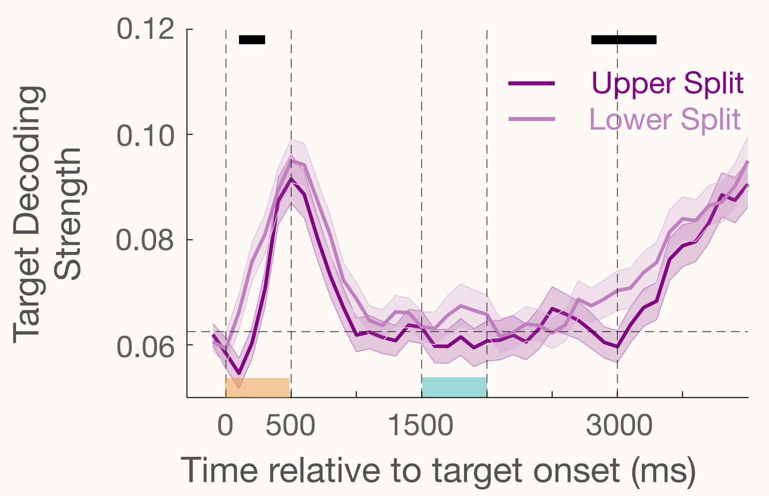
## Train on Baseline Trials (Decoder sees no probe)

- p<.05, cluster corrected


Target
Probe
Decoding Strength
Time relative to target onset (ms)

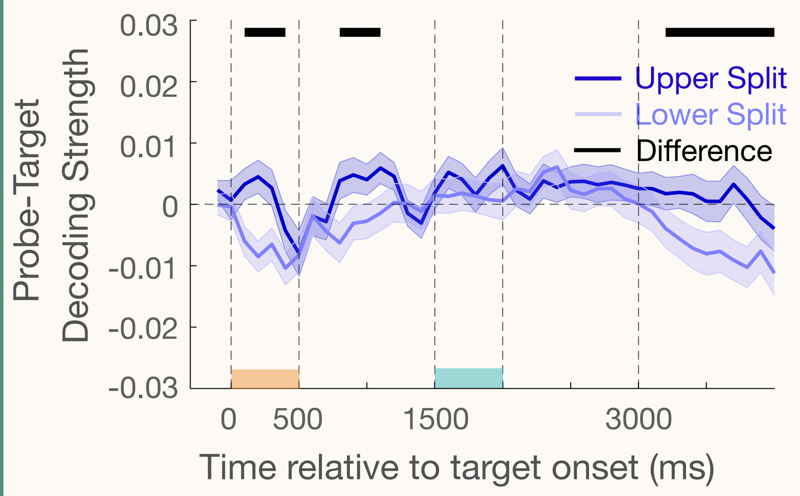
### Is Target Encoding Strength Related to Behavioral Offset?


Upper Split (More SIMB)
Lower Split (Less SIMB)
Difference
Target Decoding Strength
Time relative to target onset (ms)

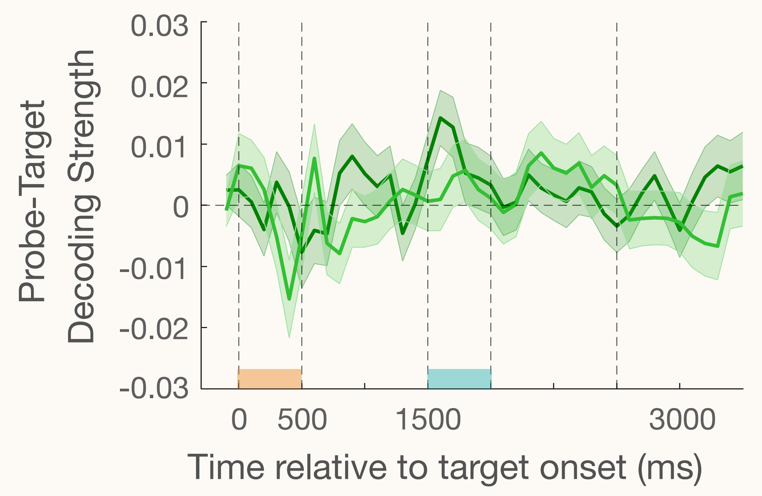

Upper Split
Lower Split
Target Decoding Strength
Time relative to target onset (ms)

**SIMB is stronger (Upper Split) for more weakly encoded trials.**

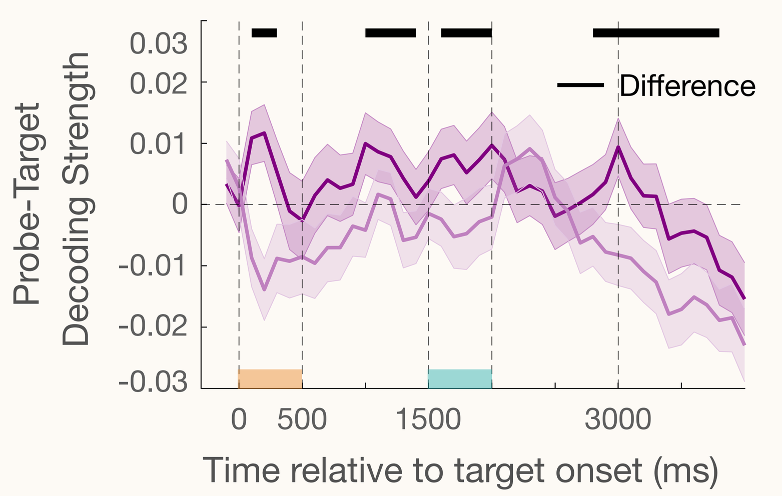
### Is Probe Strength Related to Behavioral Offset?


Upper Split
Lower Split
Difference
Probe-Target Decoding Strength
Time relative to target onset (ms)

**Trials with stronger bias have stronger probe evidence.**

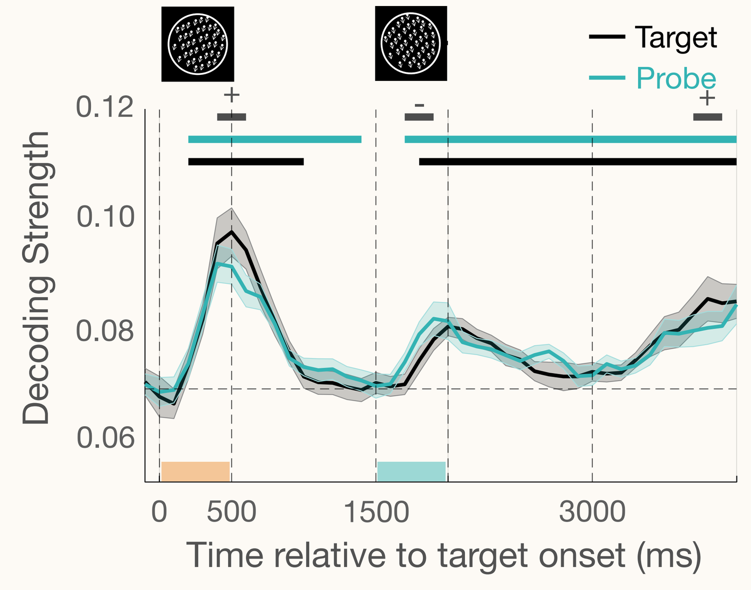

Probe-Target Decoding Strength
Time relative to target onset (ms)

**Probe evidence is not related to SIMB.**

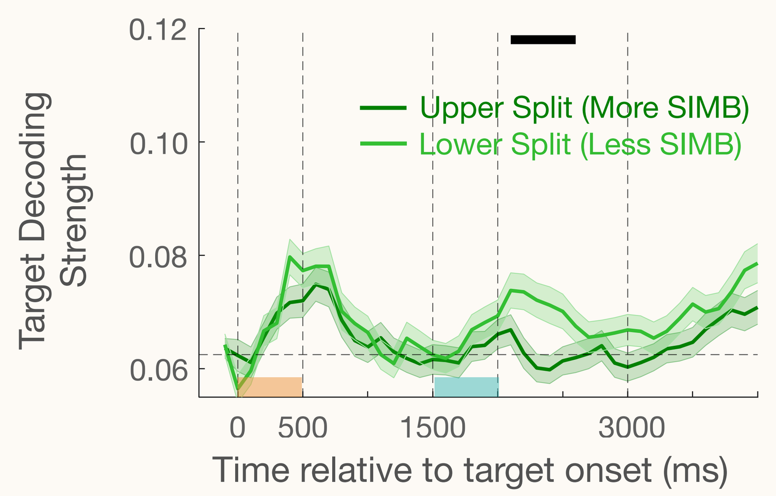

Difference
Probe-Target Decoding Strength
Time relative to target onset (ms)

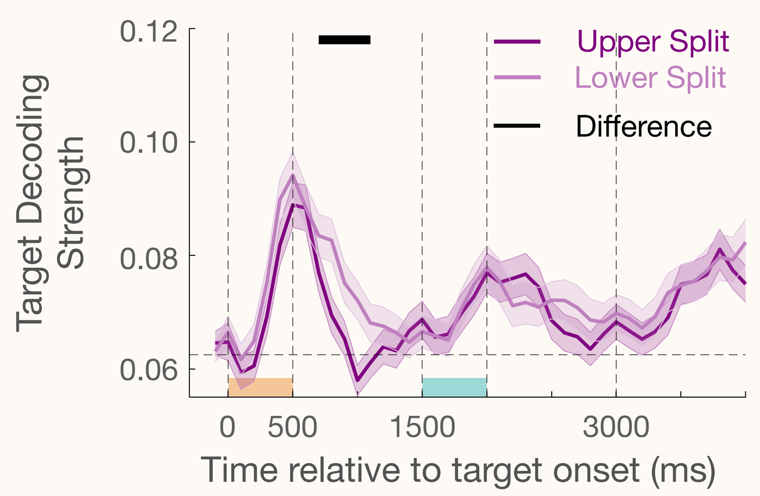
**Stronger repulsion means less probe evidence.**

## Train on Comparison Trials (Decoder sees target and probe)


Target
Probe
Decoding Strength
Time relative to target onset (ms)

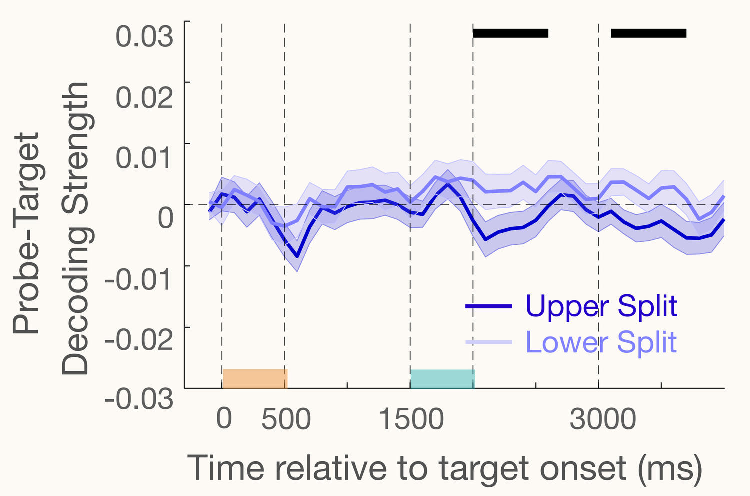
### Is Target Encoding Strength Related to Behavioral Offset?


Upper Split (More SIMB)
Lower Split (Less SIMB)
Target Decoding Strength
Time relative to target onset (ms)

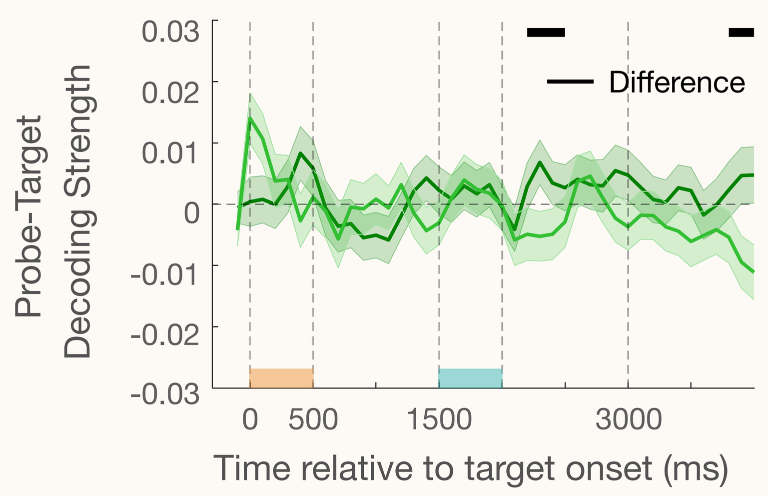

Upper Split
Lower Split
Difference
Target Decoding Strength
Time relative to target onset (ms)

**Weaker target** *(and potentially probe)* **decoding on trials with stronger SIMB!**

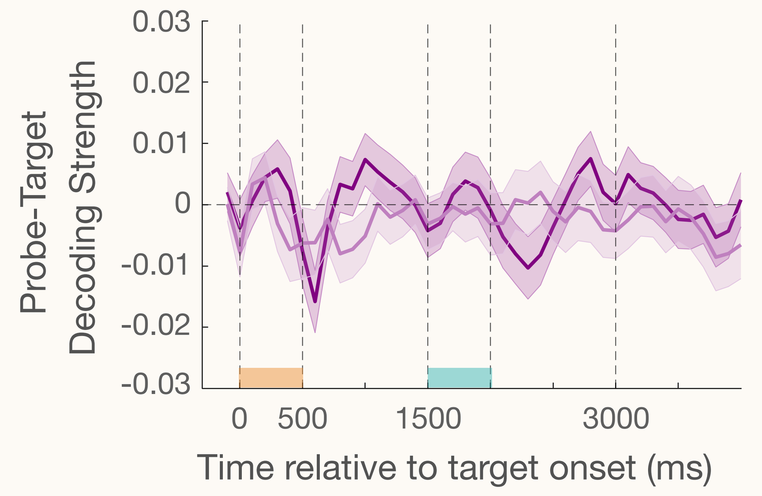
### Is Probe Strength Related to Behavioral Offset?


Upper Split
Lower Split
Probe-Target Decoding Strength
Time relative to target onset (ms)

**Counterintuitively, less probe decoding on trials with stronger bias toward probe.**


Difference
Probe-Target Decoding Strength
Time relative to target onset (ms)

**Stronger SIMB trials show stronger probe evidence after probe onset!**


Probe-Target Decoding Strength
Time relative to target onset (ms)

**No difference between upper and lower split trials!**

## Conclusion

Weaker target encoding strength results in stronger SIMB.
Both encoding strength and probe interference modulate biases in VWM.

## Reach Out!

Rademaker Lab

Fukudalab Lab

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### Random Thanks to Amit:

For being the amazing yo-yo master, winding me through science and life



Check out his cool poster!! Right now, same room 56.426