Visual statistical learning distorts feature memory

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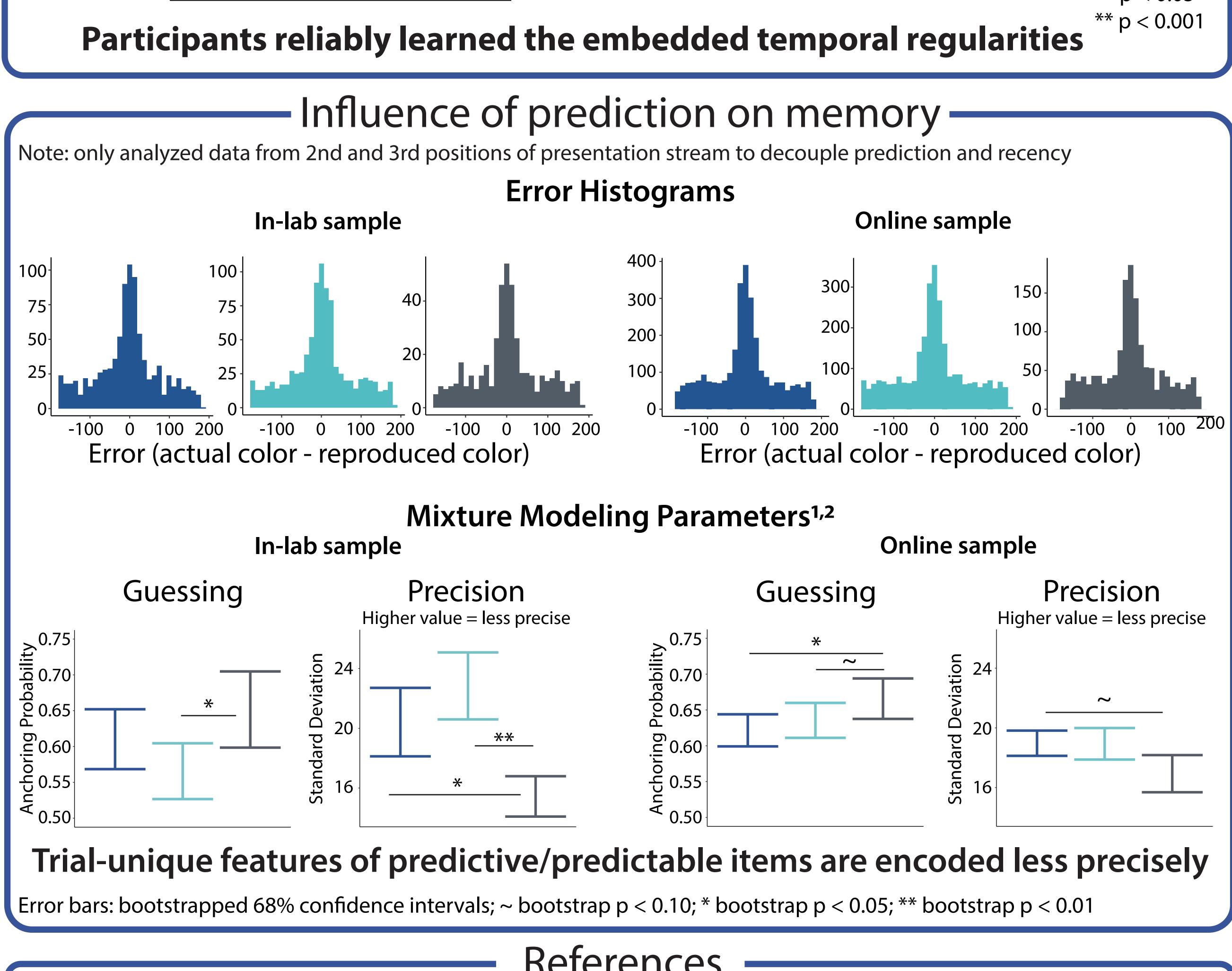Department of Psychology, Yale University

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Introduction

Our experiences contain both predictable regularities and idiosyncratic features unrelated to prediction

Reliable prediction

Actual Experiences

How do the predictive and predictable aspects of our experience influence memory for idiosyncratic details?

Experimental Design

Exposure Phase

Task: detect duplicates

A: 100% **predictive** of B
B: 100% **predictable**, given A
X: non-predictive, non-predictable

A B X X A B A B ...

12 shapes total (3 A/B pairs, 6 X)
Each item presented for 500 msec, 250 msec ISI

Short-Term Memory Phase

Presentation Stream

X A B X

Delay

1 sec

Retrieval

Familiarity Test Phase

"True Pair"

"Scrambled Pair"

First or second?

Evidence of Learning

Familiarity Test Phase Accuracy

In-lab sample
N = 30

Online Sample
N = 100

Dot = subject
* p < 0.05
** p < 0.001

Participants reliably learned the embedded temporal regularities

Influence of prediction on memory

Note: only analyzed data from 2nd and 3rd positions of presentation stream to decouple prediction and recency

Error Histograms

In-lab sample

Online sample

Error (actual color - reproduced color)

Mixture Modeling Parameters[1,2]

In-lab sample

Guessing — Anchoring Probability

Precision — Standard Deviation (Higher value = less precise)

Online sample

Guessing — Anchoring Probability

Precision — Standard Deviation (Higher value = less precise)

Trial-unique features of predictive/predictable items are encoded less precisely

Error bars: bootstrapped 68% confidence intervals; ~ bootstrap p < 0.10; * bootstrap p < 0.05; ** bootstrap p < 0.01

What about the prediction-related features?

Modified stimuli to allow for testing of shape

Same exposure & familiarity test phases as Exp 1

X A B X

1 sec

Between subjects

Probe color (prediction-irrelevant)

Probe orientation (prediction-relevant)

N = 200

Participants reliably learned the temporal regularities among oriented arrows

** p < 0.001

Memory for orientation (prediction-relevant)

Guessing — Anchoring Probability

Precision — Standard Deviation (Higher value = less precise)

Memory for color (prediction-irrelevant)

Guessing — Anchoring Probability

Precision — Standard Deviation (Higher value = less precise)

Items relevant to prediction are encoded more precisely, but so are the trial-unique features?

Error bars: bootstrapped 68% confidence intervals; ~ bootstrap p < 0.10; * bootstrap p < 0.05

Discussion

Prediction alters the way in which features of items are encoded into STM

Prediction may hurt memory in some cases and enhance memory in other cases
Role of stimulus similarity/complexity[3]? Attention[4]? Spatial cues[5]?

How are predictive and predictable features encoded relative to one another?

References

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