

Perceptual history modulates working memory biases beyond local sensory properties

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Poster PDF



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Background & Research Question

Working memory (WM) reports are systematically biased towards percepts encountered during maintenance

Report Bias

Memory Report

Perceptual Stimulus

Memory Stimulus

Most studies assume that these biases are fully explained by relational properties that vary each trial<sup>1,2</sup>

Fix demands, manipulate stimuli<sup>3,4</sup>

Fix stimuli, manipulate demands<sup>5,6</sup>

Color Space

Report Bias

However, these relational properties may produce dependencies across trials that further modulate bias

Fix stimuli, fix demands, manipulate trial history

Similar!

Dissimilar!

Similar or Dissimilar?

Does relational history between memory & perception modulate biases beyond current relational properties?

1. Lorenc, Mallett, Lewis-Peacock (2021) Trends in Cognitive Sciences  
2. Adam, Rademaker, & Serences (2022) Visual Memory  
3. Teng & Kravitz (2019) Nature Human Behavior  
4. Rademaker, Bloem, et al. (2015) Journal of Exp. Psych: HPP  
5. Saito, Kolinsky, & Fukuda (2022) Psychonomic Bulletin & Review  
6. Zhang & Lewis-Peacock (2023) Journal of Exp. Psych. General

Exp. 1 — Does recent relational history between working memory and perception modulate memory biases between identical stimuli?

Method — Short runs of similar or dissimilar target-probe pairs interleaved with identical ambivalent pairs

Trial Procedure

1000ms 500ms 1000ms 500ms Until Response

“Remember Target” “Compare Probe to Target” “Report Target” “Confidence?” “Judgment?”

High Low None

Similar? Dissimilar?

Trial Run Structure

Similar Similar Similar Dissimilar Dissimilar Dissimilar

Example Similar Pairs

Ambivalent pairs matched across similarity conditions

Example Dissimilar Pairs

Probe Sampling Procedure

Target

Similar Probe (±15°)

Ambivalent Probe (±45°)

Dissimilar Probe (±135°)

n = 40

Did history influence perceived similarity?

Proportion “Similar” Judgments

Identical stimuli were perceived as similar more often if recent pairs were similar

Relational history was implemented rapidly and sustained across the trial run

**YES! ✓**

Relational history modulated the perceived similarity of identical stimuli

Did perceived similarity track report bias?

Report Bias (Mean Signed Report Error)

Reports of the same target were attracted to the same probe more when recent pairs were similar

Report biases conformed rapidly to changes in perceived similarity

**YES! ✓**

Changes in perceived similarity tracked integration between memory & perception

Exp. 2 — Does relational history modulate integration or memory encoding?

Method — Introduce probe-free trials

Experimental Trial Runs

Baseline Trial Runs

Counterbalanced within block

Did report bias correspond with report precision?

Report Bias

Report Variability (SD Raw Error)

History-dependent changes in report bias were replicated

Relational history did not influence report precision on probe-free trials

**NO! ✗**

Fixed precision implies that history modulated integration, not memory encoding

Exp. 3 — Does the effect of relational history depend upon explicit perceptual comparisons?

Method — Manipulate task demands

1/2 blocks 1/2 blocks

“Compare to Memory”

1000ms

Similar? Dissimilar?

Until Response

“Count # of White Letters”

125ms 125ms 125ms 125ms x8

1 Letter? 2 Letters?

Until Response

n = 82

Teng & Kravitz (2019)

Did bias modulation by history generalize across tasks?

Report Bias (Mean Signed Report Error)

Relational history modulated bias even when:

- Comparison demands were removed
- Percepts were task-irrelevant
- Attention was constrained

**YES! ✓**

Generalized effect suggests observers learn & apply their knowledge of relational history automatically