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THE IMPACT OF RETRO-CUE VALIDITY ON WORKING MEMORY AND ATTENTIONAL TEMPLATE EFFICIENCY

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PREREGISTERED

BACKGROUND

Attentional template → mental representation of a target's features (e.g., shape, color) that helps us find that object in a complex scene.

Attentional templates are activated shortly before visual search to prioritize objects with matching attributes[1,2].

The dual-state model[3] suggests that only one template can be active at a time, and the others are in an accessory state.

The resource hypothesis[4] suggest that templates receive flexible amounts of cognitive resources based on their relevance.

Behavioral[5,6] and electrophysiological[7,8] studies demonstrate that multiple templates can be active simultaneously[9,10].

This challenges the assumption of the dual-state model and points to a more flexible, resource-based system.

A key prediction is that retro-cue reliability modulates how resources are allocated, influencing both memory precision and attentional efficiency.
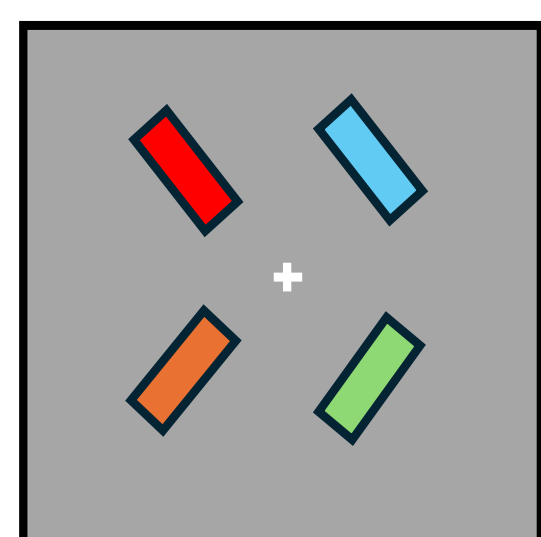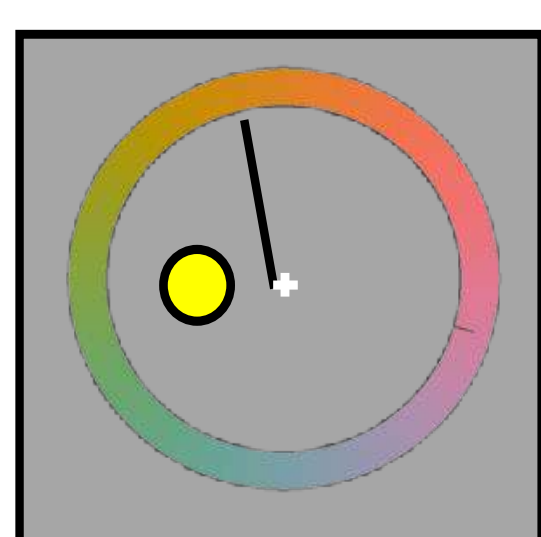
METHODS

STAGE 1-1

STAGE 1-2

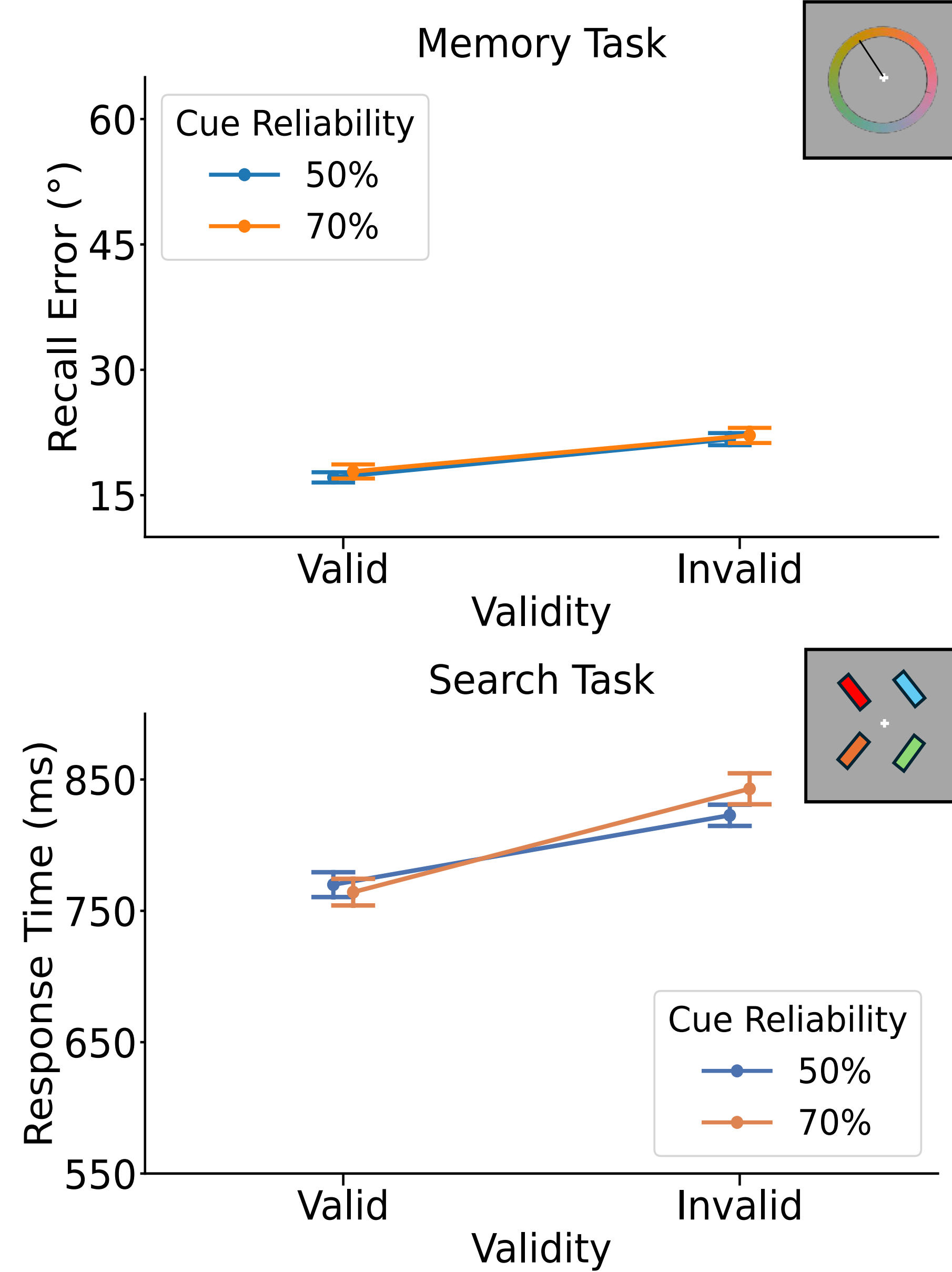STAGE 1-3

Memory task :
until response

Search task :
100 ms for stage 1.1 and 1-3
2000 ms for stage 1-2

Fixation cross (500ms) — Memory display (300ms) — Fixation cross (500ms) — Retro-cue (200ms) — Fixation cross (500ms) — Test display

STAGE 1-1
N = 25

Memory Task

Cue Reliability
— 50%
— 70%

Search Task

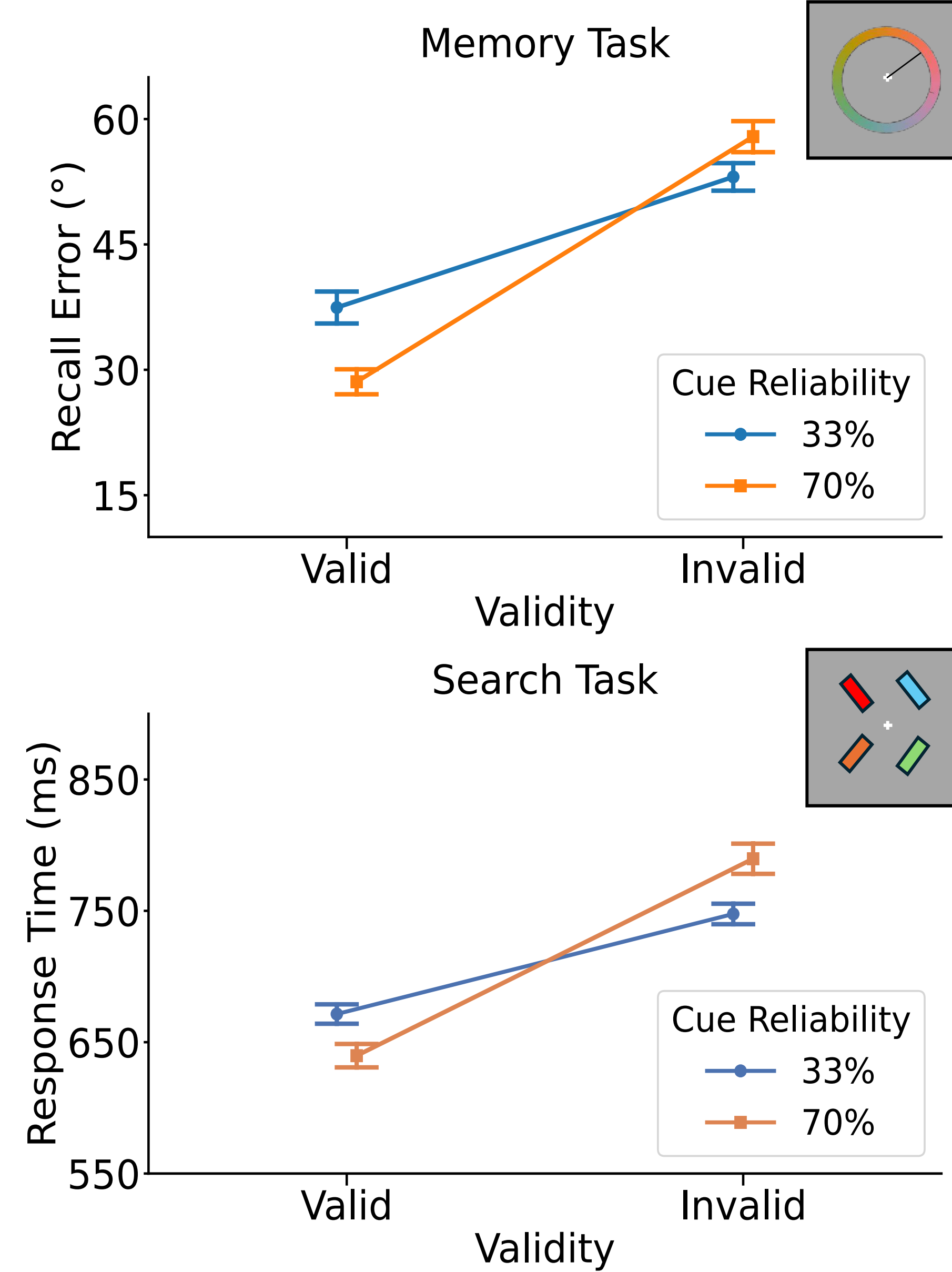Cue Reliability
— 50%
— 70%

Memory Task:
We did not find a corresponding effect in the memory task, which is contrary to our expectation that the precision of memory representations would be determined by the allocation of resources. One possible explanation for this result is that the task was too easy, possibly leading to a ceiling effect.

Search Task:
Participants performed significantly better in the valid compared to the invalid condition. The interaction between retro-cue reliability and validity was significant, suggesting that resource allocation in visual search is not fixed, but flexibly adapts to the expected reliability of the attentional template.

STAGE 1-2
N = 25

Memory Task

Cue Reliability
— 33%
— 70%

### Search Task

Cue Reliability
— 33%
— 70%

Memory Task:
Participants performed significantly better in the valid condition compared to the invalid condition. There was a significant interaction effect between retro-cue reliability and validity, which confirms our hypothesis. This pattern supports the view that attentional resources are flexibly and strategically allocated based on the expected informativeness of retro-cues.

Search Task:
Participants performed significantly better in the valid compared to the invalid condition. The interaction between retro-cue reliability and validity was significant, showing that the differences between valid and invalid trials increased with retro-cue reliability. This interaction confirms that cognitive resources are dynamically allocated based on the informativeness of the cue.

STAGE 1-3
N = 24

Memory Task

Cue Reliability
— 50%
— 70%

Search Task

Cue Reliability
— 50%
— 70%
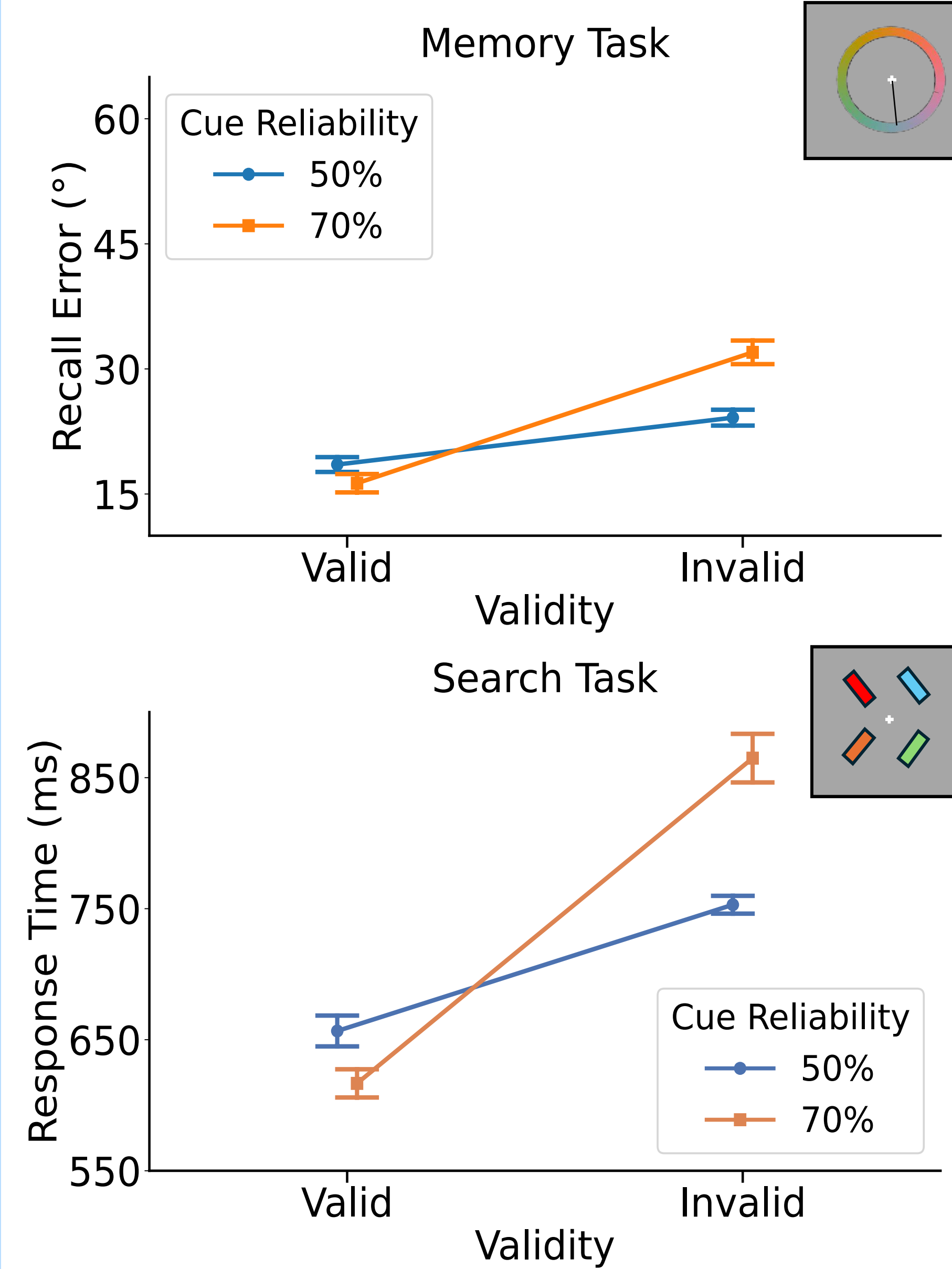
Memory Task:
Retro-cue reliability had a significant impact on participants' performance. This interaction confirms that increasing cue reliability systematically intensifies the bias in resource allocation in visual working memory. This suggests that the retro-cued item receives more memory resources when the cue is more informative.

Search Task:
Retro-cue reliability had a significant impact on participants' performance. The interaction between retro-cue reliability and validity was highly significant. This finding indicates that the more reliable the cue, the more strongly the corresponding item is prioritized in working memory.

CONCLUSION

➜ Across three experiments, we tested whether retro-cue reliability influences attentional and memory performance.

➜ We found that higher retro-cue reliability enhanced both visual search performance and recall precision, but only when the cue was valid.

➜ These effects were modulated by cue reliability: the benefits of valid cues and the costs of invalid cues were more pronounced when the cue was more reliable.

➜ Such findings are inconsistent with the dual-state model (which predicts fixed attentional status once active), but strongly support the resource hypothesis, where attentional templates receive variable resources depending on expected relevance.

➜ Our results support a flexible, resource-based system in which attentional templates dynamically adapt to probabilistic information.

CREDITS
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