

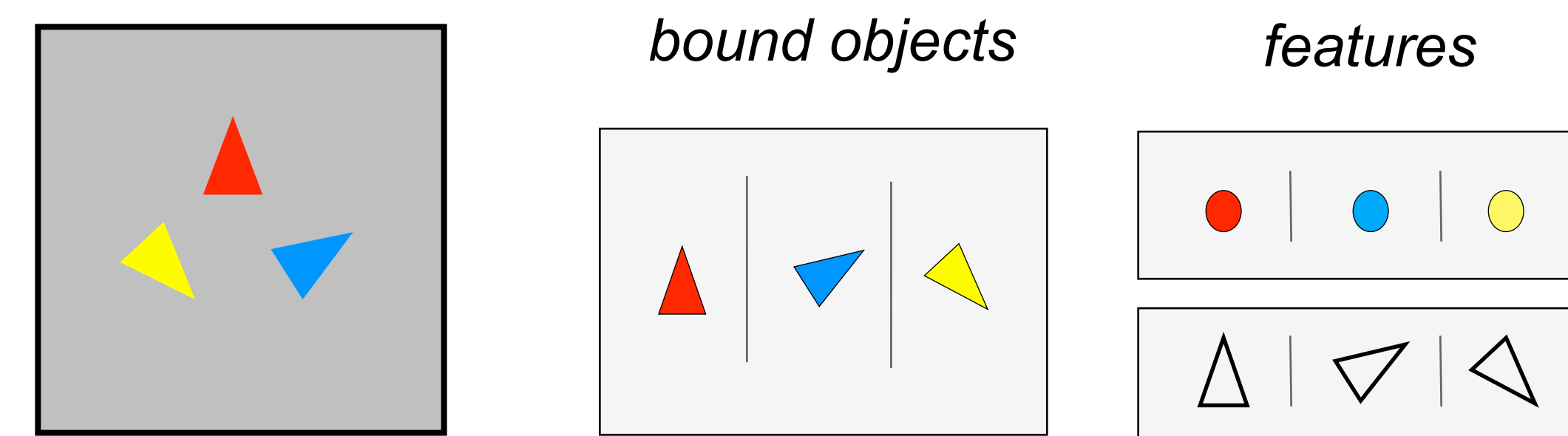
Are real-world objects represented as bound units? Independent decay of object details from short-term to long-term memory

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Background

Rich literature on binding of features into object representations in visual working memory

(e.g., Wheeler & Triesman, 2002; Gajewski & Brockmole, 2006; Fournie, Asplund, & Marois, 2010; Bays, Wu & Husain, 2011).



However, it is difficult to separate shared encoding and retrieval factors from truly bound memory representations.

Are real-world objects represented as bound units in memory?

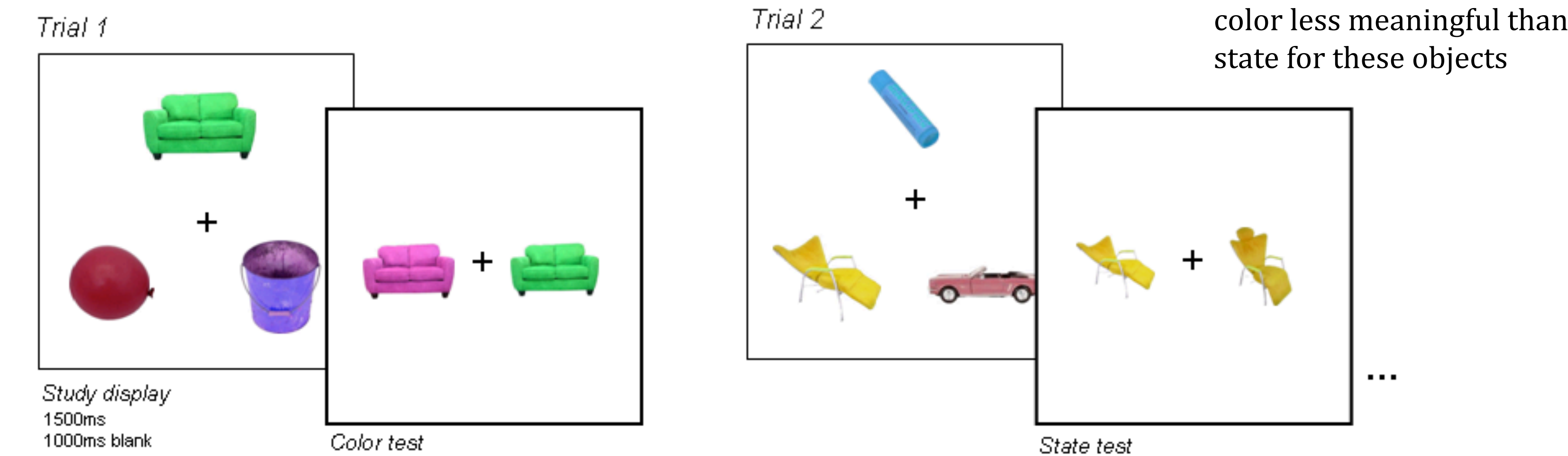
Logic of the current study:

- Manipulate delay duration
- If objects are stored in a single bound representation, the object's features will be remembered or forgotten together.
- If object features are stored separately, they may be forgotten independently

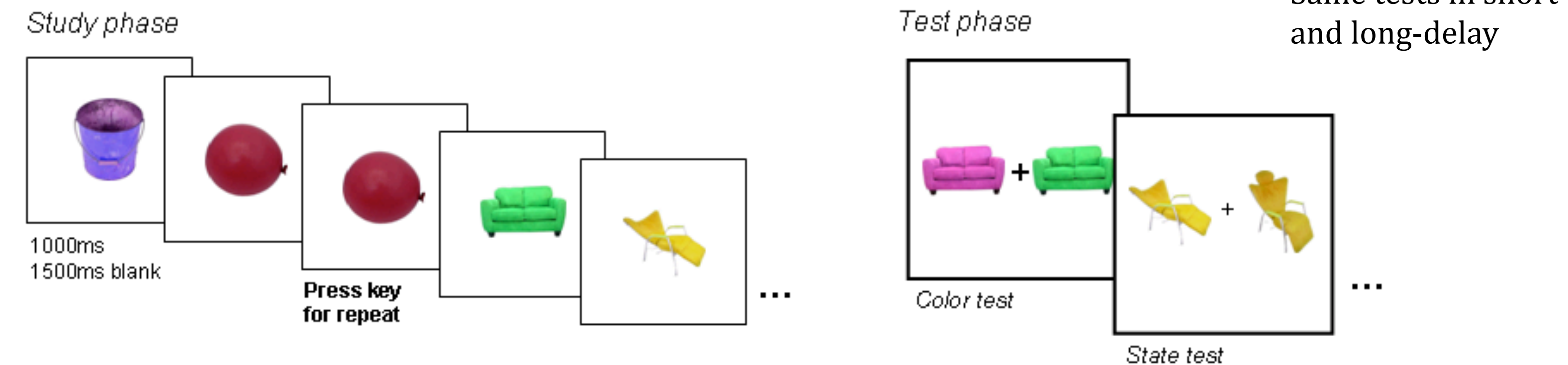


Experiment 1: Object state and color

(a) Short-delay condition - 1 sec (N=20)

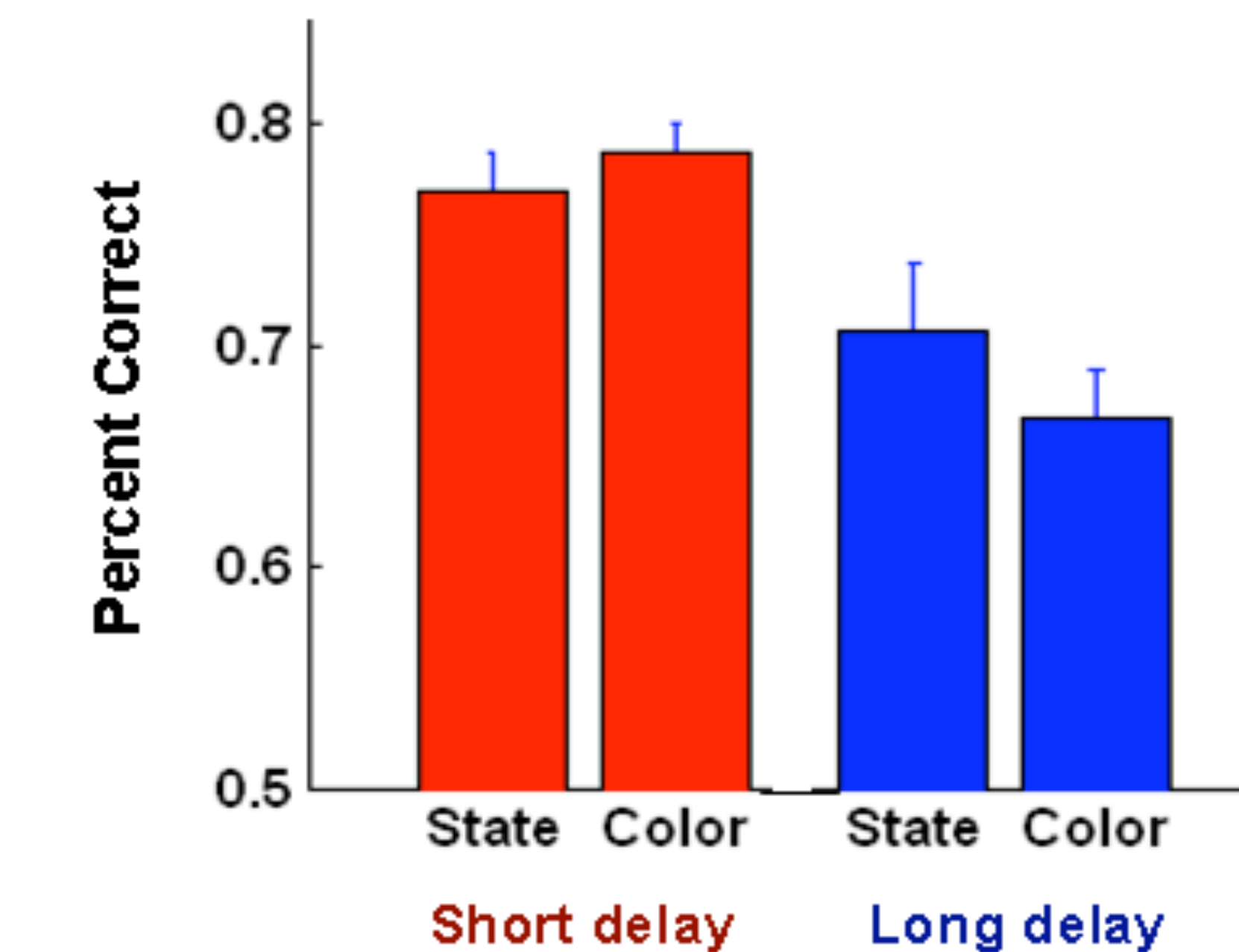


(b) Long-delay condition - 15 min (N=20)

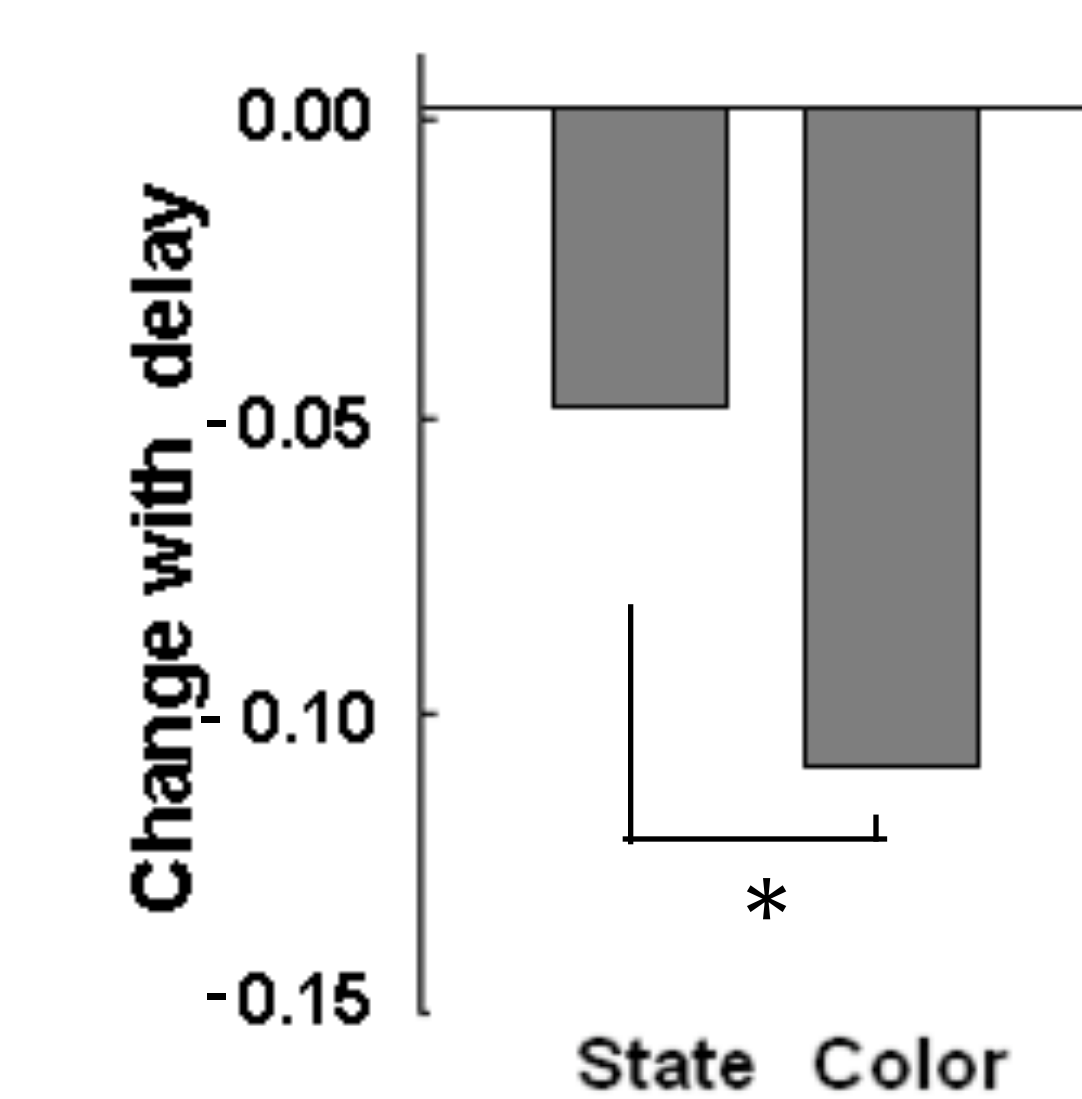


Question: Are different object features forgotten at different rates?

(a) Forced-choice performance



(b) Change with delay



Conclusion: Yes. Different rates of forgetting for state and color suggest objects do not decay as bound units.

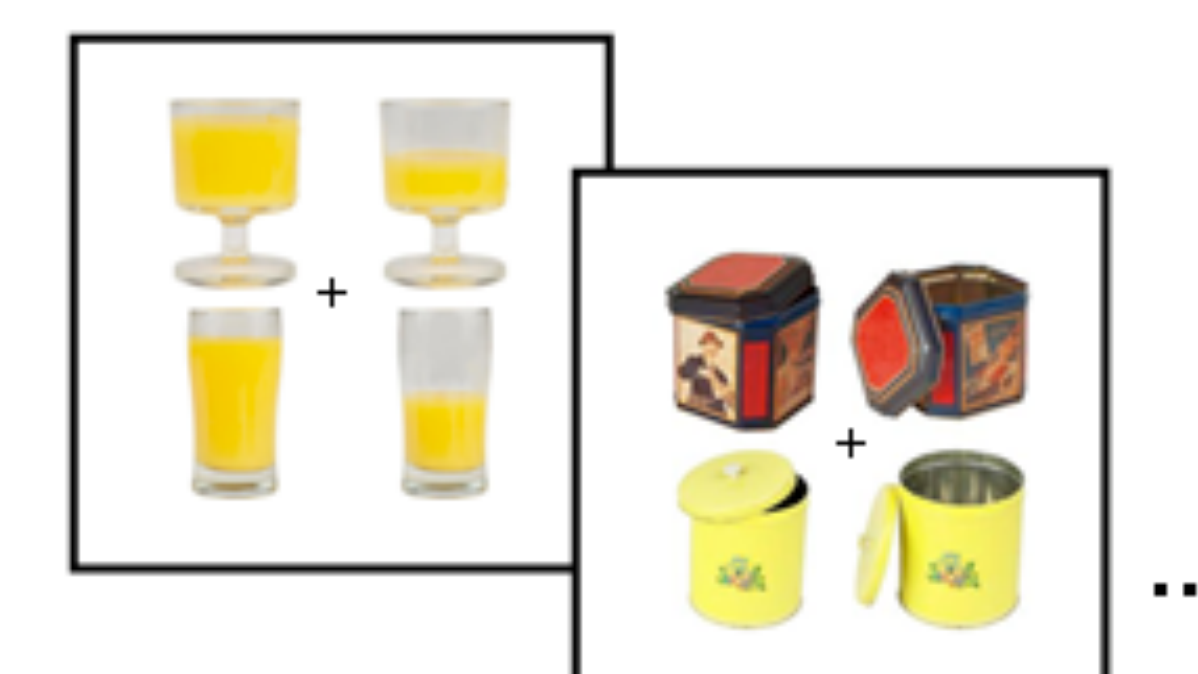
Experiment 2: Object state and exemplar

(a) Study phase



Task: Judge whether each object is bigger or smaller than a shoebox

(b) Surprise memory test

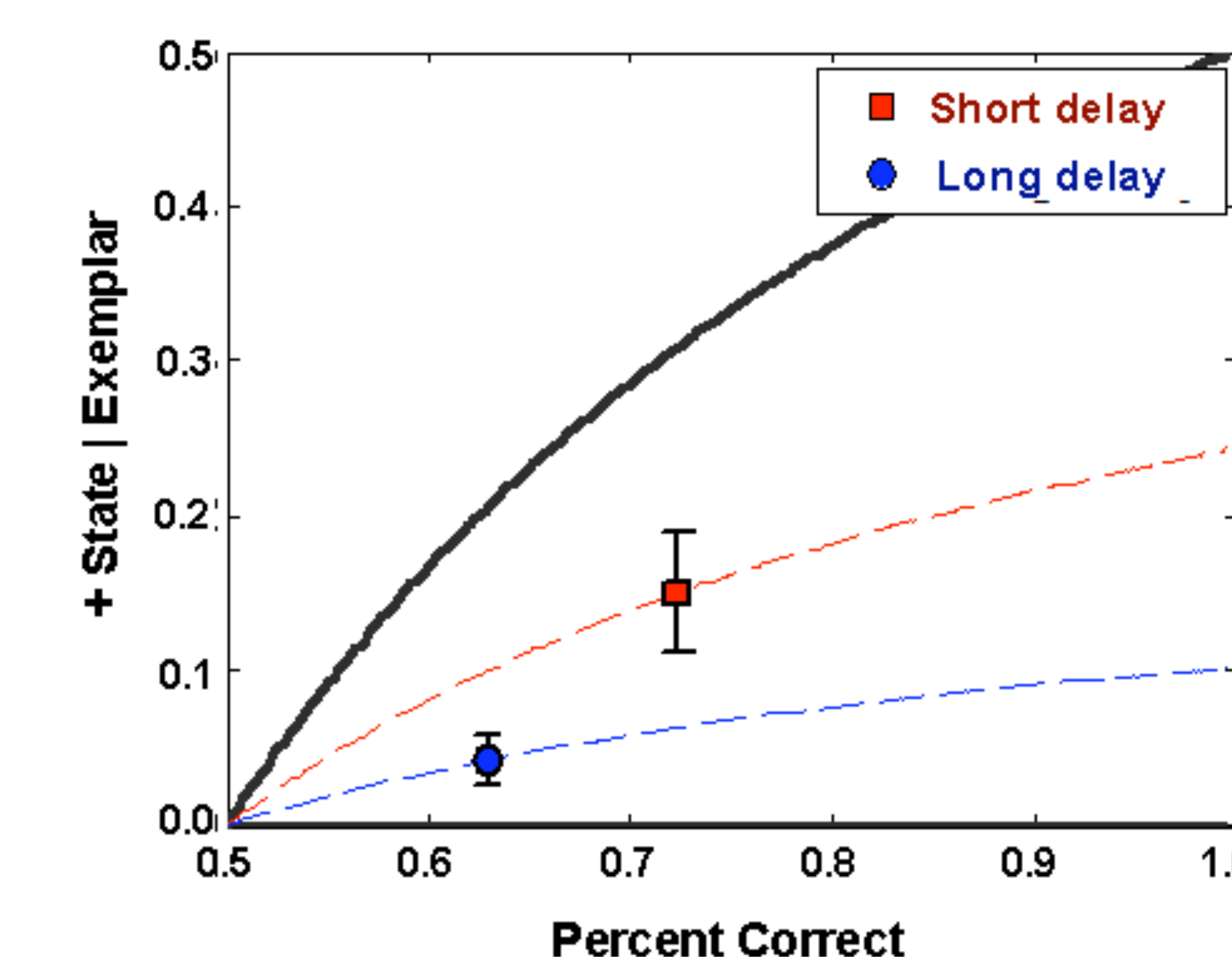


Short delay: tested immediately
Long delay: tested 3 days later

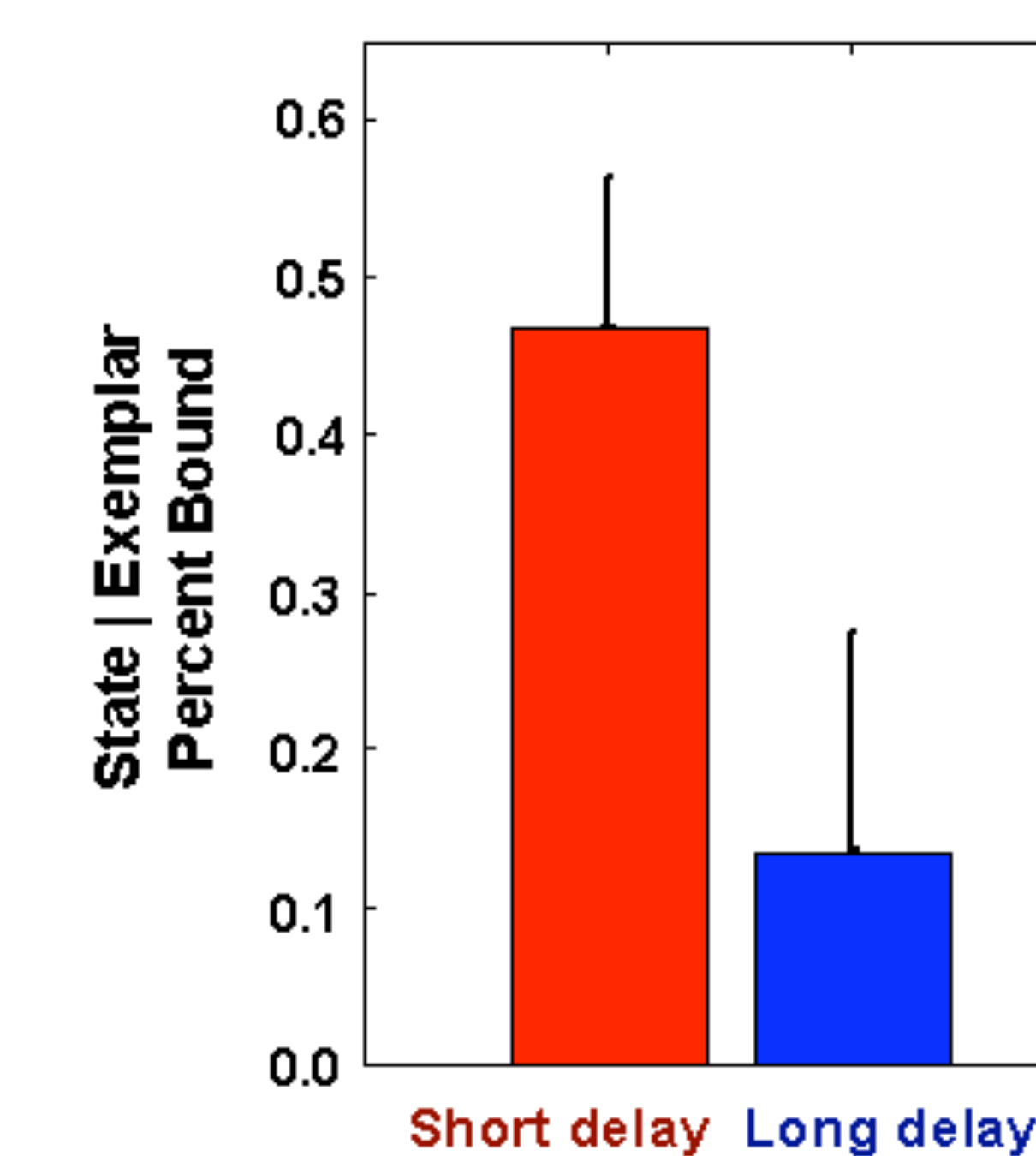
Question: Are observers more likely to remember a particular object's state if they remember the exemplar?

Initially some evidence for dependence, but this could be due to shared encoding factors *or* bound representations. With increased delay, amount of dependence decreases, suggesting representations are not bound.

(a) Forced-choice performance



(b) Boundedness over time



Conclusion: Amount of dependence between state and exemplar decreases over time. This suggests shared encoding factors lead to initial dependence, but different features are forgotten independently.

Discussion

Exp. 1: State and color

Object color is forgotten more quickly than object state, even for the same set of objects.

Exp. 2: State and exemplar

Object state and exemplar tend to be forgotten independently. Initial evidence of binding may be due to shared encoding factors like attention.

Conclusion

Information about object state, color and exemplar is forgotten independently over time.

This suggests objects are not represented solely as bound units in memory.

Independent decay of state and exemplar information also suggests these object properties are represented by somewhat independent features in memory.