

Visual working memory representations during a change detection task persist in long-term memory

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Background

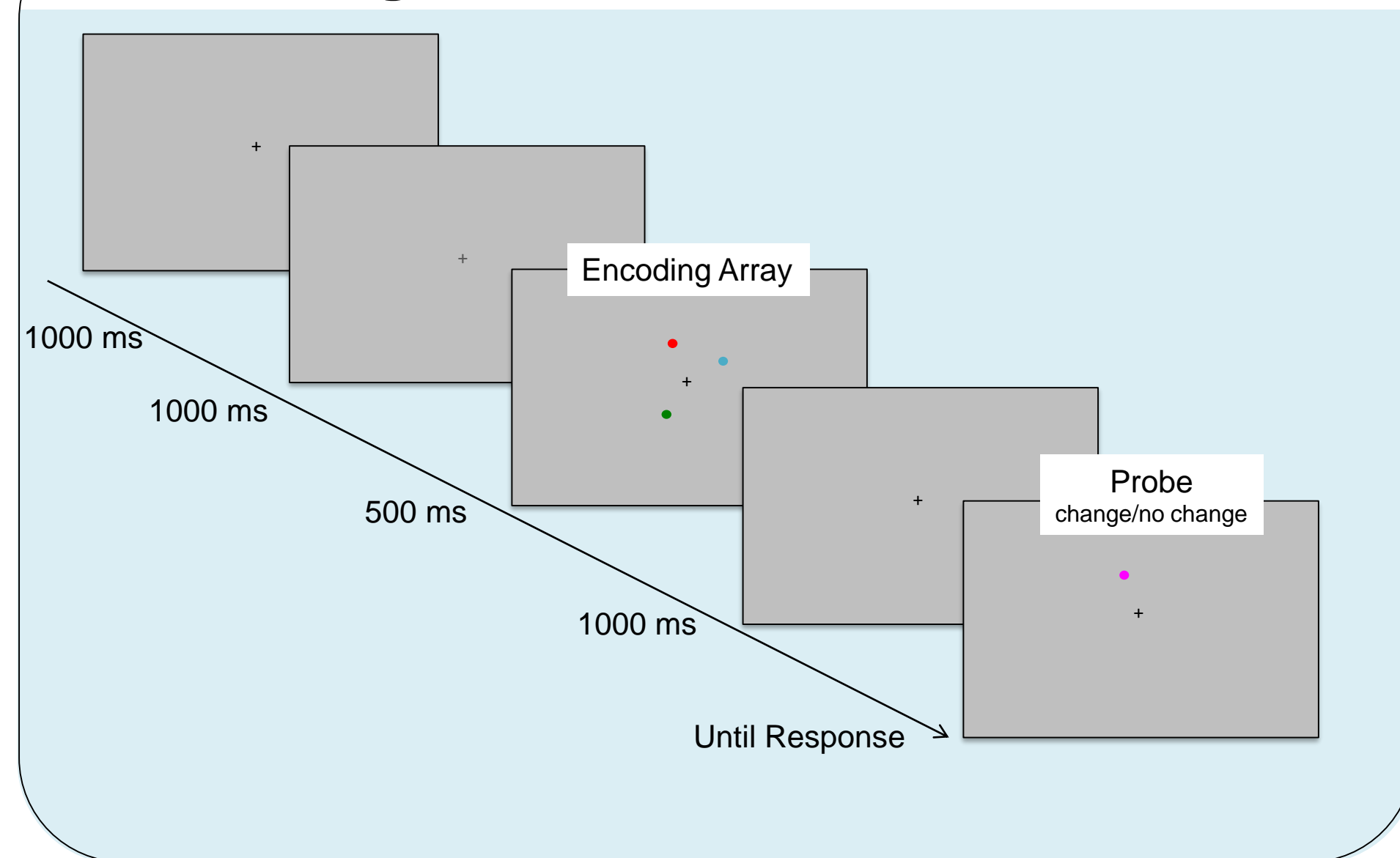
Visual working memory holds task-relevant visual information for very brief intervals. Yet, previous work also has shown that subjects can store in long-term memory details of items presented briefly only once (e.g. Brady et al., 2008; LaRocque et al., 2015). Further, proactive interference studies show that items encoded and maintained in a single trial during a change detection task influence performance on subsequent change detection trials (Makovski & Jiang, 2008). Finally, recent work has shown that ensemble statistics of visual arrays influence visual memory for individual items in the to-be-remembered set, suggesting that the overall configuration and components of the display may be also encoded in memory (e.g. Brady & Alvarez, 2011).

Here, we examined whether representations of simple displays during a change detection task persist in long-term memory.

Method

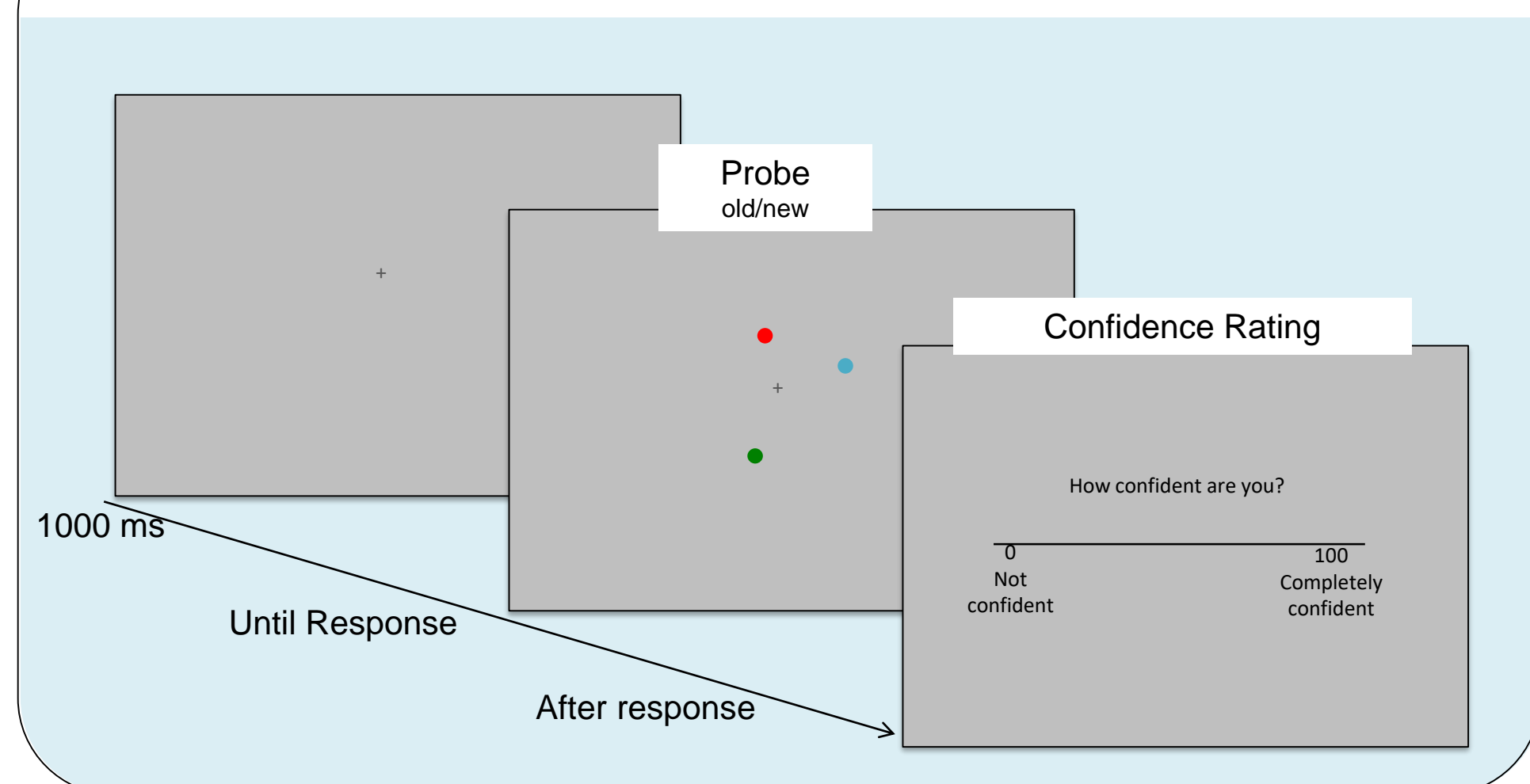
- 128 subjects performed a standard color change detection task.
- Colors on each trial were randomly drawn without replacement from a set of 10 possible colors.
- Subjects were assigned to either **Set Size 3** ($n=64$) or **Set Size 5** ($n=64$) (between subjects design).

Change Detection Trial: Set Size 3



- Interspersed** between blocks of every 6-10 **change detection trials** were **set recall trials**, in which subjects were shown a set of colored squares and were asked to report whether they had seen the set before.
- Half of set recall trials showed a set previously seen *within the first four trials* of the previous change detection block (**Old Sets**), while the other half showed new arrays (**New Sets**).

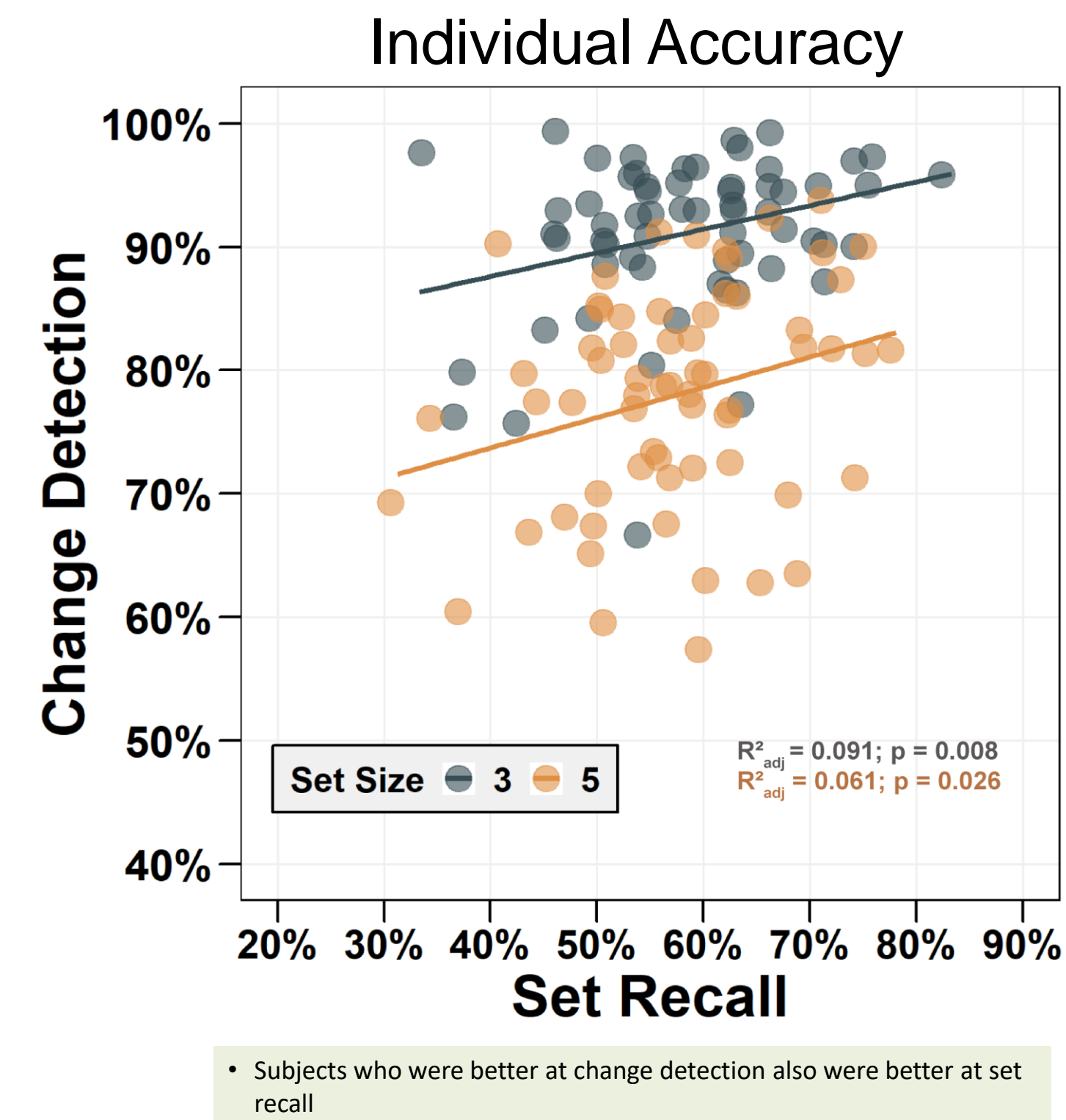
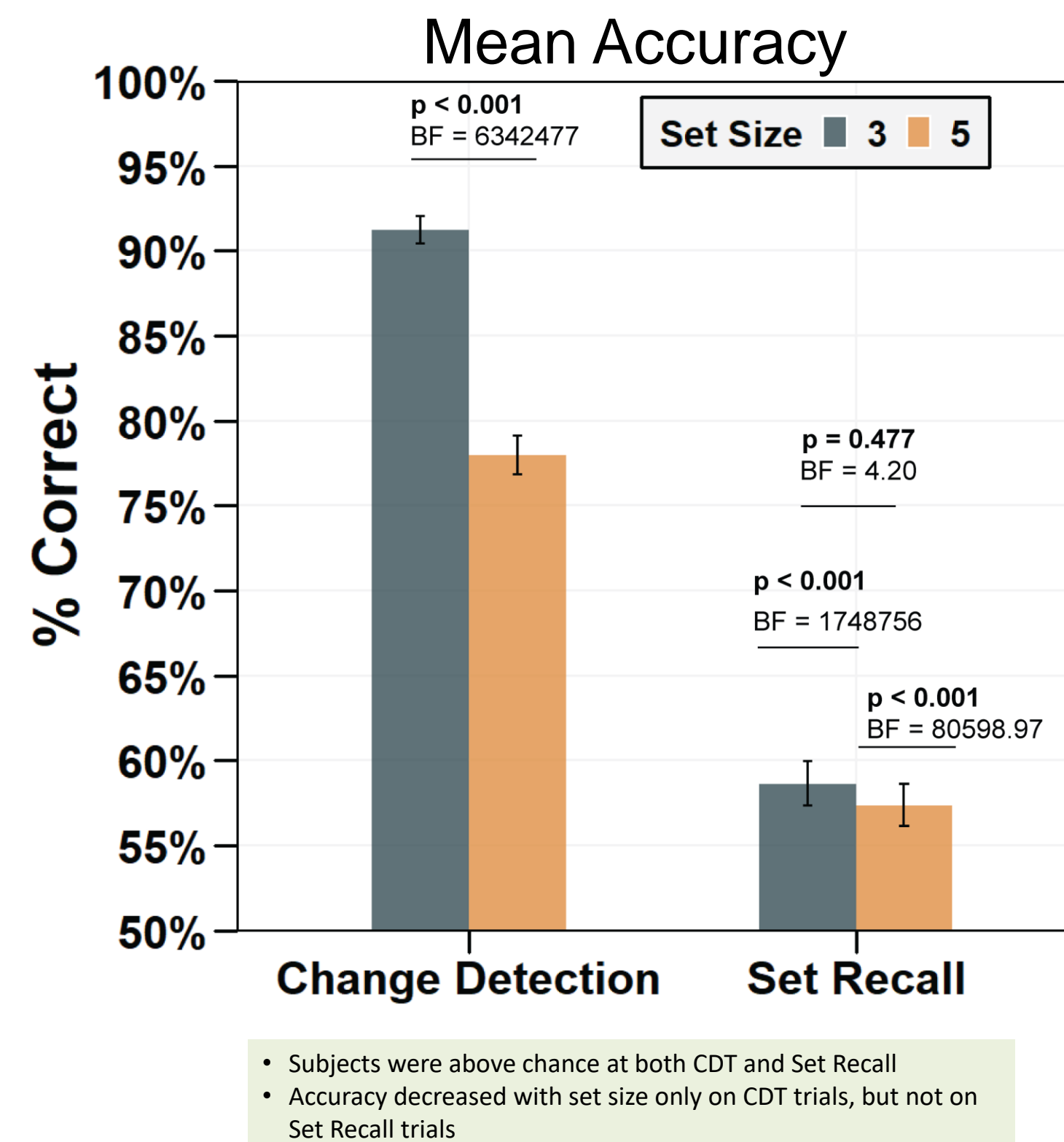
Set Recall Trial: Set Size 3



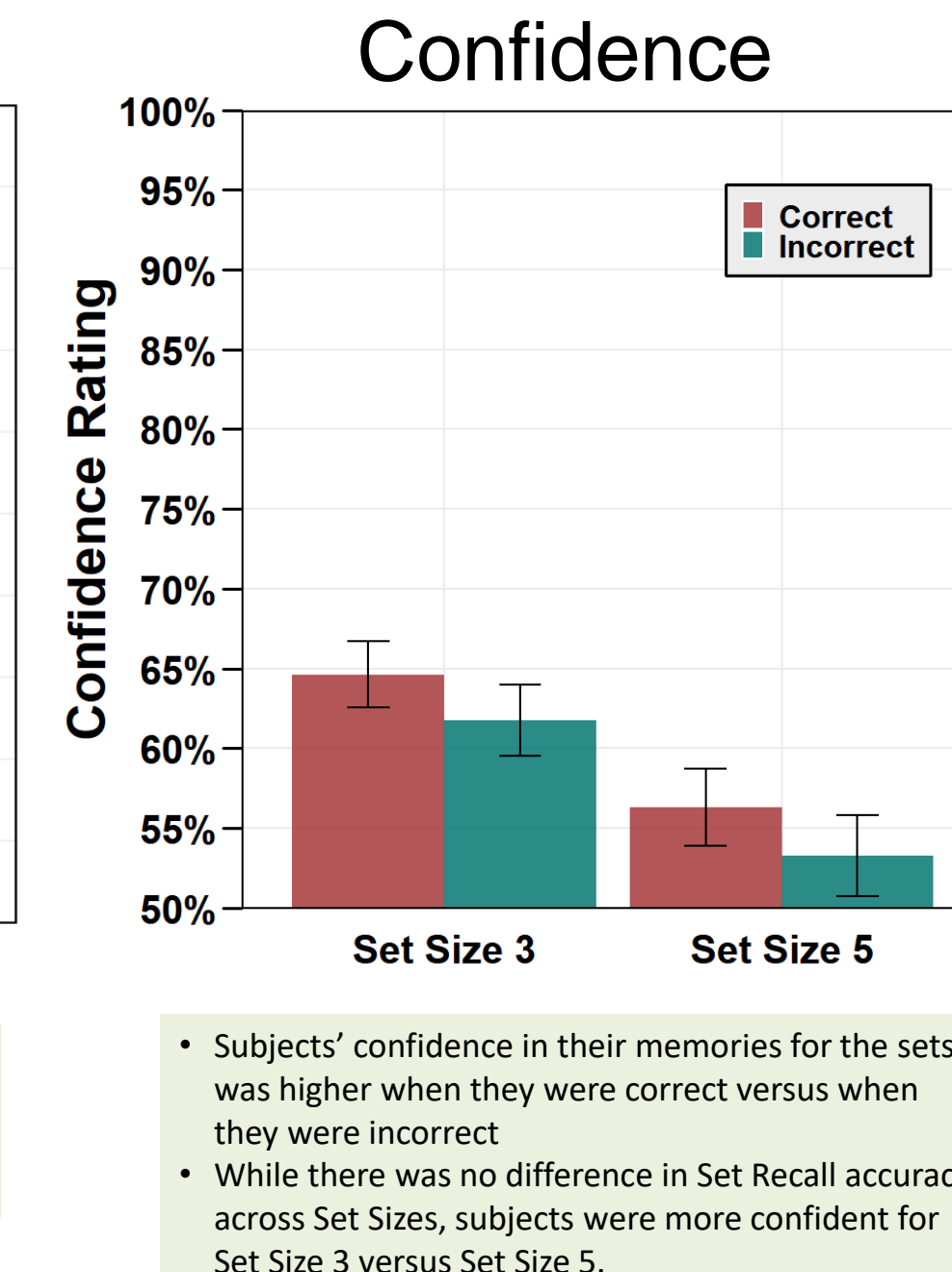
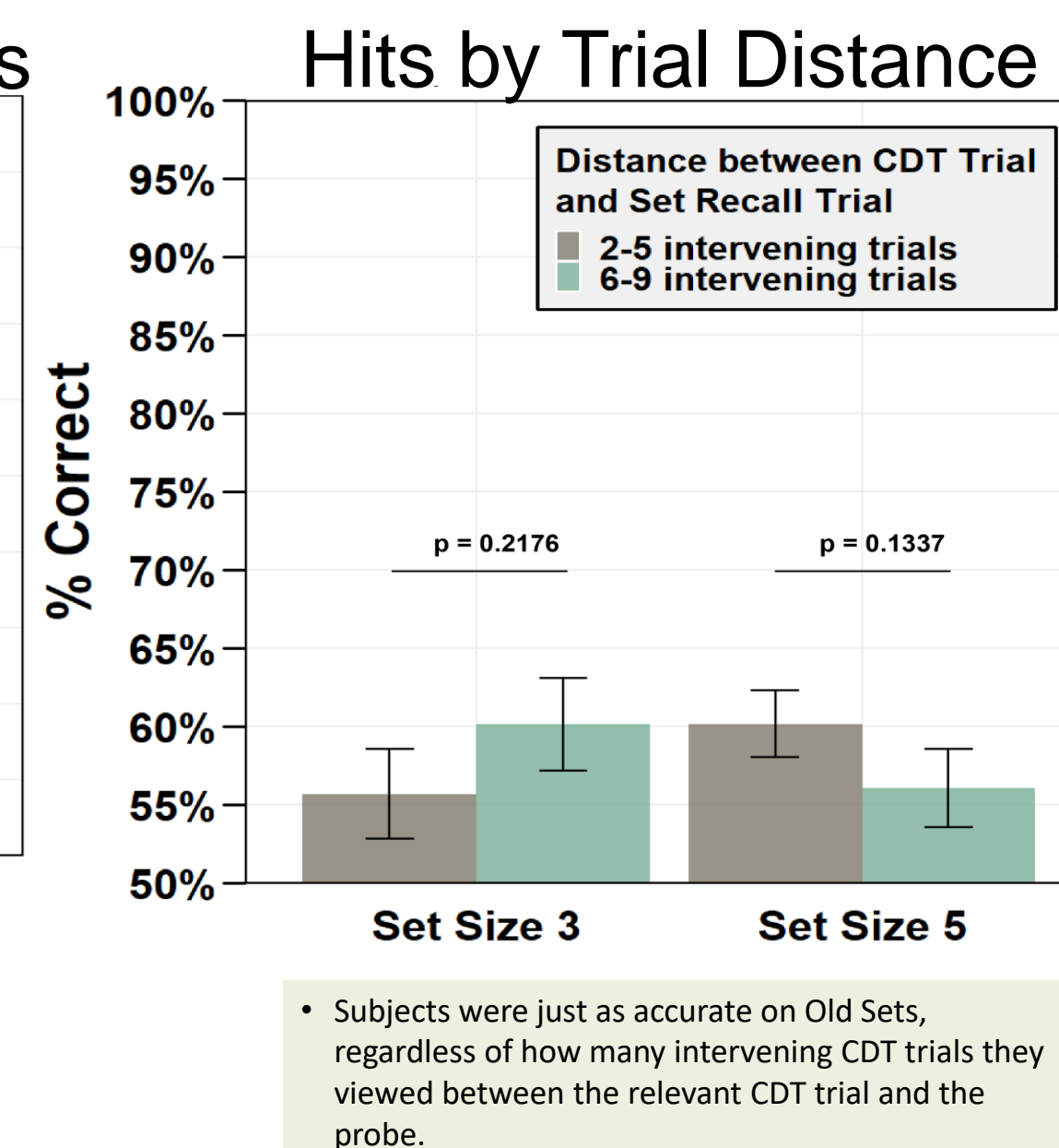
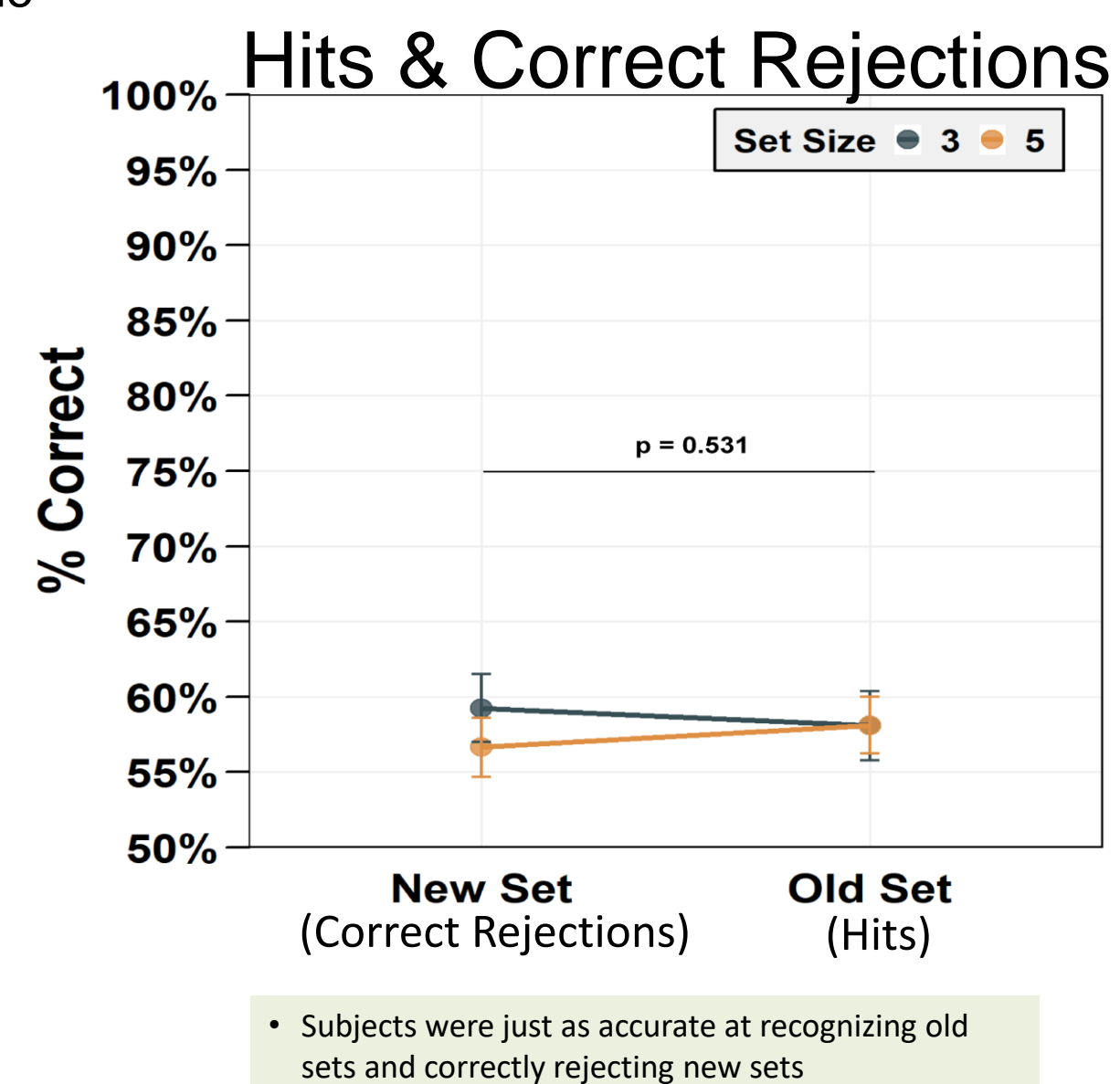
Research Questions

- Are the **configuration** and **content** of the simple sets encountered during an item-based visual working memory task stored in long-term memory?
- Is long-term memory for simple sets influenced by the number of items to be recalled in visual working memory?

Results: Overall Accuracy



Results: Performance on Set Recall Trials



Discussion

Are the **configuration** and **content** of the simple sets encountered during an item-based visual memory task stored in long-term memory? **YES**

- Sets encountered in a single CDT trial can be recalled later with above change accuracy
- Individual performance on CDT trials predicted individual performance on Set Recall trials.
- Participants performance was similar whether the sets displayed in the Set Recall trials were taken from the CDT task (Old sets) or whether they were completely novel (New sets).
- For Old sets, performance was similar regardless of how many intervening trials subjects' viewed between the CDT trial and Set Recall trial with the repeated set, indicating that items encoded in CDT trial persist over time and are immune to interference from encounters with other (highly similar) sets.
- Subjects' subjective confidence tracked their success at set recall.

Is long-term memory for simple sets influenced by the number of items to be recalled in visual memory? **NO**

- CDT set size did not influence Set Recall performance.
- While subjects were less confident in their responses as set size increased, there was no difference in their recall performance.

References

Brady, T. F., & Alvarez, G. A. (2011). Hierarchical encoding in visual working memory: Ensemble statistics bias memory for individual items. *Psychological science*, 22(3), 384-392.
Brady, T. F., Konkle, T., Alvarez, G. A., & Oliva, A. (2008). Visual long-term memory has a massive storage capacity for object details. *Proceedings of the National Academy of Sciences*, 105(38), 14325-14329.
LaRocque, J. J., Eichenbaum, A. S., Starrett, M. J., Rose, N. S., Emrich, S. M., & Postle, B. R. (2015). The short-and long-term fates of memory items retained outside the focus of attention. *Memory & Cognition*, 43(1), 43-52.
Makovski, T., & Jiang, Y. V. (2008). Proactive interference from items previously stored in visual working memory. *Memory & cognition*, 36(1), 43-52.