

Retroactive change detection of novel objects with eye tracking and odor cue assistance



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Introduction

- **Change detection** is the process of recognizing that a change has taken place in something that you are observing or had previously familiarized yourself with, while you are observing it.
- The process of **retroactive change detection** is when an object you have previously familiarized yourself with is changed, and you do not realize until you are no longer looking at it.
- With experimentation, researchers have determined that change detection is not fool proof. Even large noticeable changes can remain unnoticed under the right conditions.
- When a **sensory stimulus** (something you can smell, taste, feel, hear or see) is paired with a memory, it can increase the likelihood that you will remember the memory when you are presented with that stimulus again.

Research Questions

- Can an odor cue enhance our ability to retroactively detect change?
- Will eye tracking be able to pinpoint when a participant notices changes?

Hypothesis

- Behavior: Participants who are exposed to the odor cue will exhibit higher rates of retroactive change detection than those who are not exposed to the odor cue.
- Eye tracking: The number of fixations and the dwell time will increase with trial number as participants will notice the changes presented in Stage Two.

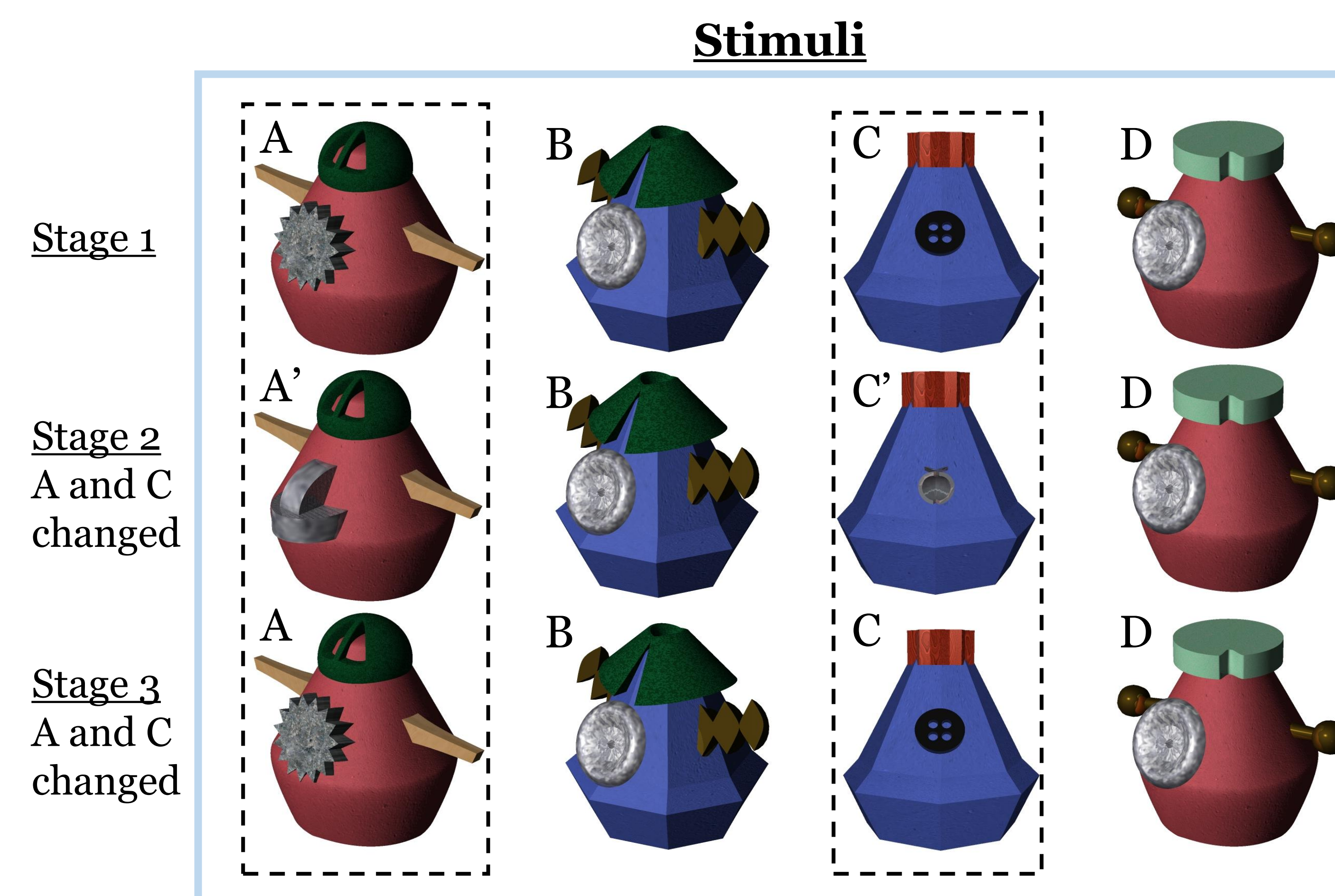
Methods

- Participants viewed four images during each of three stages in the experiment. Stages were separated by 10-minute breaks.
- Two images were identical across stages. Two images changed from Stage 1-2 and then changed back from Stage 2-3.
- An odor cue was presented during the second stage for half of participants.

Overview of Experimental Structure

Stage 1	Break	Stage 2	Break	Stage 3	Questions
View 4 objects (A, B, C, D) 20 seconds per image 1-2 minutes	10 minutes	View 4 objects - 2 unchanged (B, D) - 2 changed (A', C') 20 seconds per image 1-2 minutes	Indicate whether any objects in Stage 1 and 2 changed 10 minutes	View 4 objects - 2 unchanged (B, D) - 2 changed (A, C) 1-2 minutes	Indicate whether any objects changed across Stage 1-3 1-2 minutes
Eye Tracking					
Odor Cue					

Methods Continued...



- Upon completion of Stage 3, participants were presented with a series of questions that probed awareness of object changes.
- Retroactive change detection required that participants detect the Stage 2 changes during Stage 3 but not during Stage 2.
- Odor Cue Condition N = 11
- No Odor Cue Condition N = 11

Behavioral Results

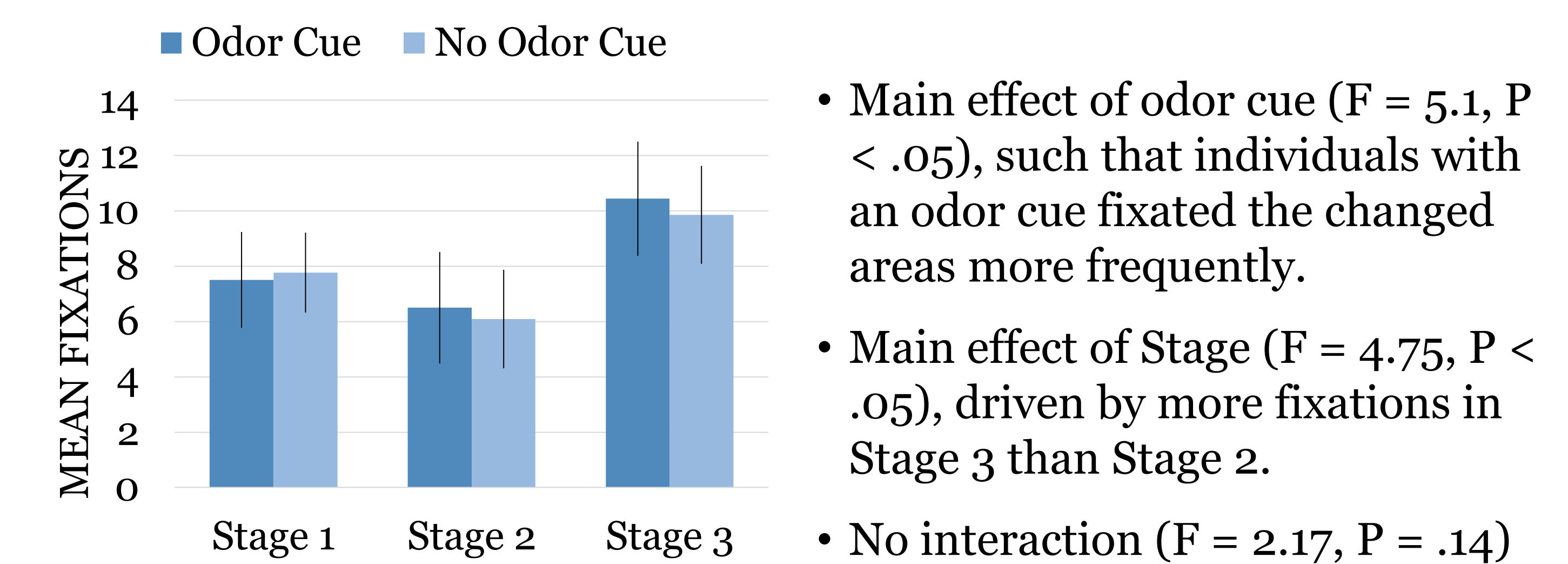
- 6 of 11 participants in the odor cue condition showed evidence of retroactive change detection.
- 5 of 11 participants in the no odor cue condition showed evidence of retroactive change detection.
- A nonparametric statistical analysis (binomial probability) indicated that the number of participants who experienced retroactive change detection was not greater than chance in either condition
 - Odor cue: 55% Change Detection, $p=1$, 95% ci=23%, 83%
 - No odor cue: 45% Change Detection, $p=1$, 95% ci=16%, 77%

Eye Tracking Results

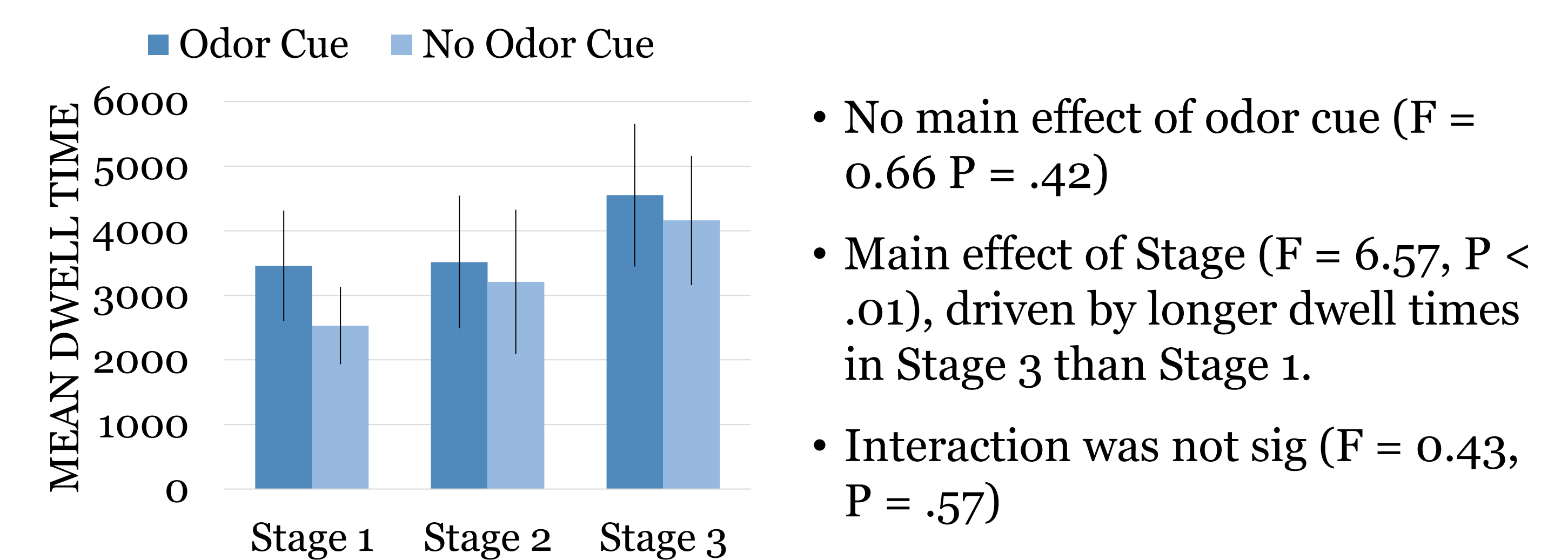
- Although our behavioral hypotheses were not supported, eye movements can reveal non-conscious expressions of memory and potentially change detection.
- To this end, we targeted number of fixations and dwell time as dependent measures, with a particular focus on eye movements oriented toward areas of the objects that changed across Stages.

Eye Tracking Results Continued

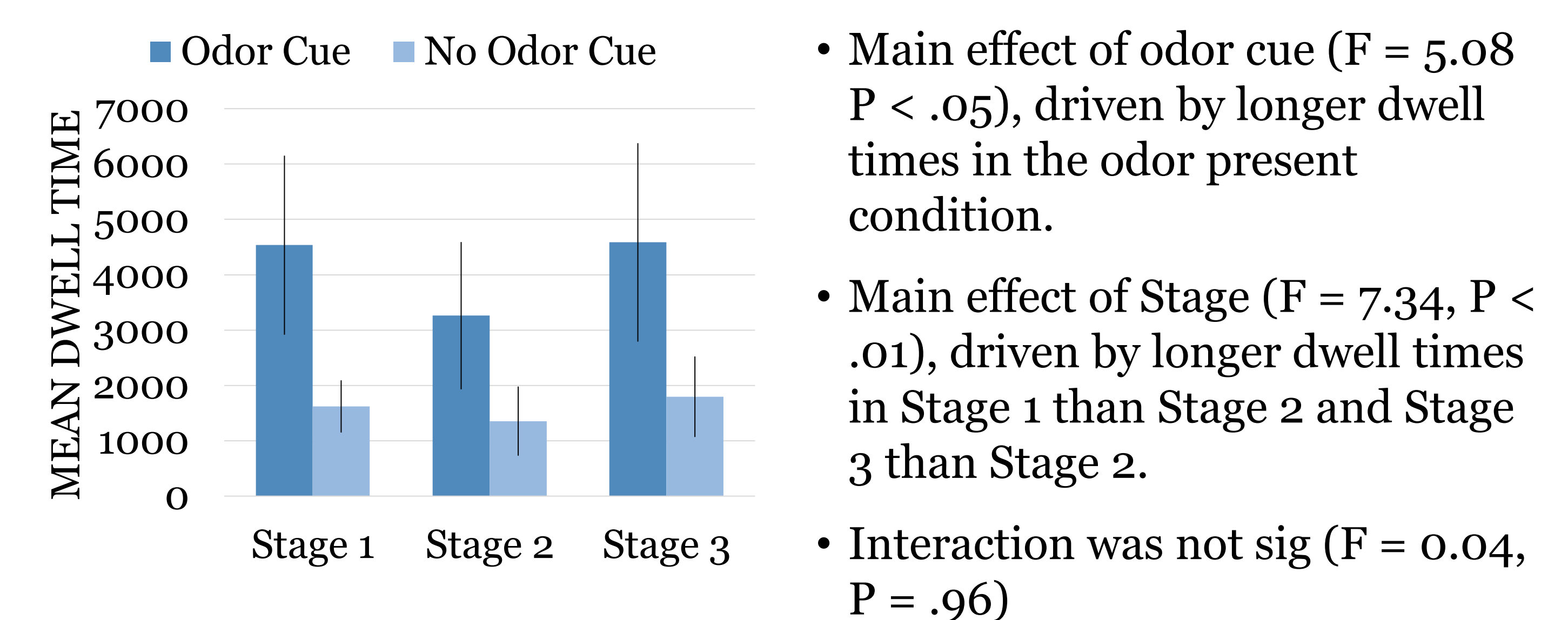
Fixations to Changed Areas of Objects



Dwell Time on Changed Areas of Objects



Dwell Time In Retroactive Change Detection



Conclusions

- Due to the small number of participants, most of the behavioral and eye tracking data is currently inconclusive.
- However, the behavioral data indicated that, of the participants that exhibited evidence of retroactive change detection, those who were given the odor cue demonstrate twice the dwell time of those not given the odor cue.
 - This pattern of results is consistent with the idea the hypothesis.
- More studies of this nature are required to draw conclusions and answer the research questions.