

The Relationship Between Change Detection and Visual Memory: Evidence From Target Postcuing

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1 INTRODUCTION

What is the nature of the visual memory representation constructed during scene viewing? On the one hand, change blindness experiments suggest that visual memory may be limited to the currently attended object (e.g., Rensink, 2000). On the other hand, recent studies have demonstrated accurate memory for the visual form of previously attended objects (Hollingworth & Henderson, in press; Hollingworth et al., in press). These latter studies support the proposal that visual representations from local objects accumulate in memory as the eyes and attention are oriented within a scene. But if so, why would change blindness occur at all?

This study tested the possibility that change blindness may result from constraints on retrieval and comparison processes rather than from impoverished visual memory. Heretofore, it has been widely assumed that change detection performance directly reflects visual memory capacity. This assumption has received support from evidence that a cue specifying the target object in a changed scene (i.e., a *postcue*, which allows participants to limit retrieval and comparison to a single object) does not improve the detection of changes to abstract stimuli (Vogel et al., 2001). In contrast to abstract arrays of stimuli, however, change detection in real-world scenes may benefit from postcuing, because real-world scenes contain far more visual information relevant to the change detection decision, and because the set of potentially changing objects is not specified.

2 OVERVIEW OF EXPERIMENTS

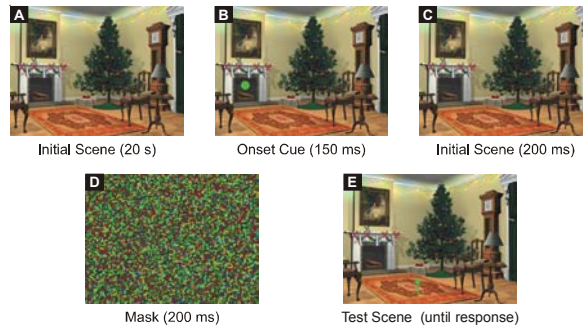
Participants viewed 42 3D-rendered scenes. On each trial, an initial scene was displayed, followed by a test scene. The test scene was either identical to the initial scene (*same* condition) or identical except for a change to a single object. Two types of changes were possible, a *token change* and a *rotation change*.



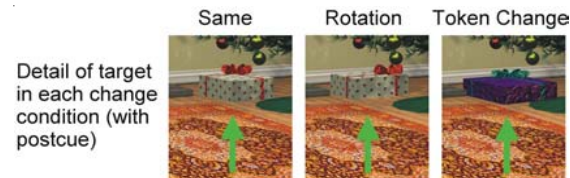
Sample Scene

3 METHOD

Sequence of Events in a Trial



The *onset cue* was used to manipulate where participants were attending when the scene was masked.



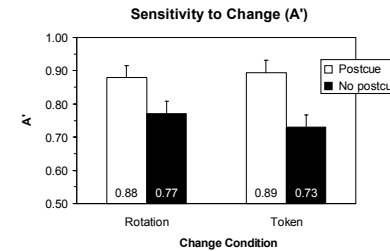
4 EXP 1: Postcue Manipulation

A *postcue* condition was compared with a *no-postcue* condition. If change blindness derives from retrieval and comparison constraints, change detection should be more accurate when retrieval and comparison can be limited to the target.

The abrupt appearance of a green disc on a non-target region prior to the change (invalid onset cue) ensured that participants were not attending the target when it changed, on the assumption that abrupt onsets capture attention (e.g., Yantis & Jonides, 1984).

To correct for differences in response bias between experimental conditions, the hit and false alarm rates were used to calculate A' , a non-parametric measure of sensitivity.

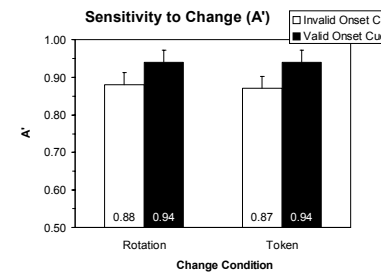
5 EXP 1, continued



Change detection was reliably higher when a target postcue allowed participants to limit retrieval and comparison to the target.

6 EXP 2: Onset Cue Validity

In Exp 2, the onset cue appeared on the target object in half the trials (*valid onset cue* condition) and on a non-target object in the other half (*invalid onset cue* condition). Given that each scene contained many potentially changing objects, participants should have incentive to direct attention to the object cued by the abrupt onset. Invalid trials then provide a strong measure of detection performance in the absence of attention. All targets were postcued in the test scene.

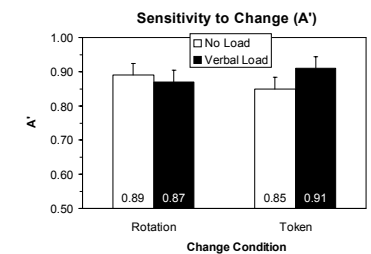


Valid cueing led to higher rates of detection (see also Scholl, 2000), but change detection in the invalid onset condition remained excellent, and at levels similar to those in Exp 1.

7 EXP 3: Verbal WM Load

To test whether accurate change detection derives from verbal (as opposed to visual) representation, a verbal WM load of four digits (which participants repeated aloud throughout the trial) was introduced on half of the trials. All onset cues were invalid and all targets were postcued.

8 EXP 3, continued



The verbal WM load did not reduce change detection performance.

9 CONCLUSIONS

The standard change blindness effect was observed when participants were not provided with a target postcue.

However, change detection performance was significantly improved when a postcue allowed participants to limit retrieval and comparison processes to the target. (see Simons et al., in press, for a complementary postcuing effect using real-world encounters)

In addition, excellent change detection performance was still observed when a verbal working memory load was introduced, suggesting that the relevant representations were indeed visual.

In summary, these data support the view that visual representations from local objects accumulate in memory as the eyes and attention are oriented within a scene. When constraints on retrieval and comparison are lifted, change blindness is cured.

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