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Temporal requirements for configuration, switch, and shape-change detection in novel objects

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Abstract

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◆ **Temporal requirements for configuration, switch, and shape-change detection in novel objects**
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While we are surprisingly poor at detecting changes in our visual environment, some changes appear to be detected more readily than others. Specifically, changes to the configuration of an object's parts are detected more often than changes involving the shape or switching of parts. The aim of this study was to ascertain the minimum amount of time required to adequately process each of these different types of object changes. Using both one-shot and flicker-change-detection paradigms, we manipulated the duration of each stimulus exposure (40–500 ms, mask duration constant at 160 ms). We found that, at 40 ms stimulus duration, change detection accuracy was close to chance in the one-shot task, but was significantly above chance in the flicker task. For both tasks, and at longer stimulus durations, configuration changes were always detected more accurately than shape changes. Stimulus repetition in the flicker task provided little additional benefit to configuration-change detection. While configuration changes tended to be detected more accurately than switch changes in the one-shot task, no difference between the two was found in the flicker task. These findings suggest that at shorter stimulus durations memory consolidation is needed to accurately detect switch changes.

◆ **Effect of goals of cognitive activity on change detection in scenes: Visual representations evolve with goals of task**
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Though change-blindness experiments revealed visual representations of scenes included information about the attended object with an abstract scene schema, they did not explore how visual representations could evolve with cognitive activity. With a change blindness experiment joined to a problem-solving task, we examined observer's ability to report changes on visual scenes while they performed a problem-solving task. In this task, observers had to move a car on a city map displayed on screen, and reached specific sub-goal stages, to achieve the final goal. We assumed that changing the same stage at different moments of the task should have different effects on change detection. As expected, observers reported only changes occurring to the current sub-goal stage with no detection of changes occurring to immediately task-irrelevant stages, even though these changes concerned further relevant stages for the overall problem solving. Moreover, change detection depended on the type of change: stage deletions were more accurately detected than stage displacements. These results suggest that (i) visual representations are basically functional and progressively vary together with task requirements, (ii) the visual system extracts the information just sufficient to solve the current goal from the visual scene, and (iii) change blindness does not result from comparison blindness.

◆ **The effect of gist change in image recognition**
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Since the gist of a scene is very quickly processed (Potter, 1975 *Science* **187** 965–966) and is preserved in memory (Simons and Levin, 1997 *Trends in Cognitive Sciences* **1** 261–267), it is likely to be used in detecting changes between images. We therefore expected changes altering the gist of an image to be detected faster and more accurately than changes not altering the gist, even when those changes affect a larger area of the image. A change in gist can be generated by, for instance, adding Dracula teeth to the man of a loving couple. Swapping the hair colour of the couple can generate a change that does not alter the gist. We tested this in an experiment in which participants had to indicate as quickly and accurately as possible whether an image was exactly the same as an image seen in a study phase. The effect of gist on change detection was tested on twenty-four participants who viewed 10 images in the study phase. In the test phase they made 60 same/different decisions. The alterations in gist were detected significantly faster and more accurately. This suggests that gist is one of the first things used for image recognition.

◆ **Category effects on implicit-change detection**
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Although observers are often very poor at reporting changes to their visual environment, such changes could be processed by the visual system in the absence of awareness and can affect the subsequent behaviour. In two experiments, we found that, after an image change, observers