Change Blindness

Change blindness (CB) refers to the finding that people, in certain circumstances, are surprisingly poor at detecting large changes in visual scenes. This entry will present the methods used to produce CB and discuss how CB findings have informed thinking about the role of attention in scene viewing and about the complexity of visual representations.

In a classic demonstration of CB, observers attempted to detect a change while a photograph of a jet on a runway alternated with a photograph in which the engines had been removed. When a brief (~80 ms) blank frame was inserted between the two images, the change became very difficult to detect, requiring up to 40 alterations between the pictures for successful detection. Once the large change was detected, most people were amazed that they failed to notice it sooner. This method of producing CB by inserting a blank frame between the two images is called the flicker technique. CB can also be produced when the two images are separated by an eye blink, an eye movement (saccade), or a camera cut in a video, when an occluding event momentarily blocks the view of the change, the change co-occurs with the appearance of a number of “mud-splashes,” or when the original scene slowly morphs into the altered image. These varied methods all have one critical aspect in common: When they are implemented, the change fails to produce a clear and isolated motion transient. Changes that produce a single clear transient are readily detected; but when people are unable to rely on a transient and must instead rely on their knowledge of the contents of the scene, CB often results.

In the 1990s, these CB findings garnered a great deal of interest. The use of real-world scenes combined with the surprising results revived interest in scene viewing and led to questions about the role that attention plays in the process. A number of CB findings support the conclusion that change detection in these circumstances requires focal attention. For instance,
changes to items that are of central interest in the scene are more easily detected than changes to items of marginal interest. Given that attention should be preferentially allocated to central interest items, this finding is consistent with the view that attention is necessary for change detection. Second, changes become easy to detect if one is cued to attend to the location of the change prior to the change occurring. These findings suggest that attention is necessary for change detection.

Other results, however, suggest that attention to an object may be necessary but not sufficient to detect a change. For instance, research finds that people often fail to notice when the main actor in a video is replaced with a different actor during a camera cut. Even in real-life interactions, people often fail to notice when the person they are giving directions to changes to a new individual, provided the direction giver’s view of the swap is blocked by an occluding event. Clearly, in these situations the person who changes is the focus of attention, yet CB results. These observations suggest that one must not only attend to the object in order to detect the change, but must attend to the specific aspects of the object which would allow one to detect the change.

The findings concerning the role of attention in change detection support the view that only attended aspects of a scene are represented with sufficient detail and longevity to allow an observer to readily detect changes. Presumably, these attended aspects are represented within visual working memory and this representation is durable enough to allow a comparison of the pre-change item to the post-change item. The conclusion that attention is require for conscious recognition of an object is consistent with conclusions from other methods such as inattentional blindness and the attentional blink.
In addition, the findings that people are often poor at detecting changes seem to indicate that people’s mental representations of visual scenes are far less complete and complex than previously assumed. At the extreme, the findings were used to suggest that people’s subjective experience of a rich and detailed visual representation of the world was an illusion. Instead, it was argued that mental representations of visual scenes were extremely sparse and volatile, changing as the focus of attention switched to different items within the scene.

Although CB research was used to promote this view, other researchers suggested that the CB findings may underestimate the amount of visual information that is represented. This position is supported by evidence demonstrating that people are implicitly aware of changes, suggesting that changes are represented at some level, even if that level is not able to support conscious report. In addition, people began to argue that CB could result from a storage failure or a comparison failure rather than a failure to initially represent information from a scene.

Research following up on these potential shortcomings has demonstrated that people extract more visual information from scenes than CB suggests, storing these visual details in a visual long term memory of the scene. Thus, CB does not seem to probe the entire contents of visual representations, but instead seems to probe the immediately available contents of visual working memory.

As a result, change detection paradigms are currently used to probe the contents of visual working memory and to track the deployment of attention in a scene. In the working memory research, it is assumed that an item is represented within working memory if changes to it are detected. In the attentional tracking research, the time required to find a particular change is used as an indication of when attention was deployed to that aspect of the scene.

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See also Attention and Consciousness, Attentional Blink Effect, Inattentional Blindness, Visual Working Memory, Visual Attention

**Further Readings:**
