

Change blindness and visual memory: research and theories



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What is change blindness and what can it tell us about attention?

Recent research on visual memory has shown that people have great difficulty in detecting obvious changes to an object, such as colour and size, if the change occurs simultaneously with a distraction. The term change blindness is used to describe this phenomenon and much research has been carried out to further our understanding of the condition. Research on change blindness has also produced valuable information about how our visual attention is involved in the encoding process.

A variety of tests have been developed to test the prevalence of change blindness and the results show that it is a robust phenomenon. Although change blindness was studied many decades ago it is only in the last decade that research in this area has increased dramatically. Earlier research relied on using shapes or novel objects to induce change blindness and therefore some argued that the condition was caused by artificial stimuli. However, Grimes (1996) showed that more natural images could be used to induce change blindness. Using a computer screen he showed observers photographic images of natural scenes and asked the observers to remember as much of the photograph as possible for a later memory test. However, during a saccade (when observers were visually scanning one object to another in the image) the image was altered. The observers were then asked if they noticed if anything had changed to the image. Invariably, observers were oblivious to the changes even when they were major ones, such as two people exchanging heads. Although previous experiments had shown the existence of change blindness, Grimes' 1996 study was the first to show that individuals can fail to detect major alterations to images.

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Moreover, Grimes used everyday natural images thereby bringing demonstrations of change blindness closer to everyday perceptual experience. Other similar studies also showed that different distracters could be used to induce change blindness. For example, during eye blinking (O'Regan *et al* 2000) or by applying 'mudsplats' in the surrounding area of the objects that were changed (O'Regan *et al* 1999).

The fact that distractions are needed to induce change blindness suggests that attention is needed for change perception. Without distracters it is very easy for an observer to notice any change that has taken place. This led researchers to investigate the role of attention in change blindness and now there is mounting evidence that attention plays a pivotal role in the condition. For example, in change blindness tasks it has been found that attention to objects can vary depending on the objects' location and this can influence whether the change is detected. This has been demonstrated by studies such as Rensink *et al* (1997). They developed the 'flicker' task which involves using an original and altered image that is repeatedly shown to the observer with the two images separated by a blank screen for a fraction of a second. As with other distracters the observers demonstrated change blindness by invariably taking a long time before they noticed the change to the original image (average being 40 repeats). Another interesting finding of this study is that the observers found it easier to detect changes to objects that were the 'centre of interest' of a scene than objects that were of 'marginal interest' even when the changes were of equal physical salience. This has also been found in other change blindness studies. Levin & Simons, (1997), for example, found the same effect when they changed movie

objects during a film cut. One theory to explain this finding is that focused attention is required to detect change. This makes sense as a change of any object is always accompanied by a motion signal and therefore attracts attention to the site of change. This allows the change to be observed. However, if the signal is too weak (e. g., because of distracters such as saccades or blanking) it will fail to draw attention to the location of the change which will result in change blindness (Rensink *et al* 1997).

Change blindness can also be demonstrated in real-life situations. Simons and Levin (1998) carried out an experiment in which members of the public were approached by an experimenter who asked for directions. During their conversation two actors carrying a large occluder would walk between the experimenter and subject. At this point the experimenter would swap places with a colleague who would continue the conversation with the subject. The findings showed that some individuals failed to notice that the experimenter had swapped places with another person even though the differences between the two were obvious, such as size and different clothes. This study was important because it showed that change blindness could occur using complex stimuli usually found in the real world. Therefore, finding change blindness can occur in more naturalistic settings counteracted some claims that it was only caused by artificial disruptions, such as the blanking-out distracter in the flicker paradigm (Simons & Rensink 2005).

There are several theories that attempt to explain change blindness in relation to the interaction between attention and visual perception. For example, Rensink (2000, 2001) developed his coherence theory. This theory is based on several assumptions. First, prior to focussed attention there is an <https://assignbuster.com/change-blindness-and-visual-memory-research-and-theories/>

initial stage of processing across the visual field of view. This processing produces representations of several objects in the field of view, but the representations are not stable and therefore are quickly replaced by new stimuli at their location. Second, focused attention produces a very detailed and longer-lasting representation of the object. This allows the representation of the object to be more stable which can withstand brief interruption. Therefore, a change in a focused object will be easily detectable. Third, removing focussed attention will result in the representation of the object disintegrating and returning to the unstable state it was prior to focussed attention.

From the above assumptions it follows that only changes made to objects that are the focus of attention will be detected. This can explain why change blindness is a common phenomenon, because any changes to an unattended object will not be detected.

The assumption that attentional processes are crucial in underlying change blindness is a common one. For example, Hollingworth and Henderson (2002) agree with the assumption. However, they propose an alternative theory of the relationship between attention and object perception. They argue that detailed perceptions are formed when we look at objects which are the focus of attention. These representations are then incorporated into a mental map and information about these visual representations is then stored in the long-term memory. Therefore, multiple fixations of a scene will result in information accumulating in the long-term memory about local objects from both the attended and previously attended areas, and this

forms a detailed representation of the scene as a whole (Hollingworth and Henderson 2002).

There are several differences between Hollingworth and Henderson's theory and the coherence theory that have implications about understanding the role of attention in change blindness. First, if objects change, (e. g., disappear or move) sometime after they were attended to, according to Hollingworth and Henderson they would still be mentally visible for some time after the change. Therefore, any change has a good chance of being noticed. Whereas the coherence theory predicts that when attention is withdrawn from objects the mental representation of such objects disintegrate rapidly and therefore any change will result in change blindness. Second, unlike the coherence theory, Hollingworth and Henderson assume that detailed representations of most scenes are stored in the long-term memory. Therefore, any changes made to objects should be detected several minutes later. Finally, in the coherence theory it assumed that focusing attention on an object produces a very detailed image that can withstand a brief interruption, such as a saccade. In contrast, Hollingworth and Henderson believe that less detailed visual representations are made when the object is the focus of attention. To date, research has not provided clear evidence to support either Hollingworth and Henderson's theory or the coherence theory (see Simons & Rensink 2005 for an overview). Therefore, further investigations are required to better understand the interaction between attention and change blindness.

Change blindness is a robust phenomenon that has been demonstrated in many different laboratory and naturalistic studies. The overall assumption of <https://assignbuster.com/change-blindness-and-visual-memory-research-and-theories/>

the findings of change-blindness experiments is that attention seems to play a major role in determining the extent of the condition. The importance of attention in change blindness appears to arise because we do not maintain a detailed representation of what we have just seen. Otherwise individuals would have little problem noticing the obvious changes that occur between images. Change blindness studies have proved a useful tool in providing information about the processing mechanisms of attention, such as we direct attention more to objects of interest within a scene. However, although studies on change blindness have increased our understanding of attention there is much debate about the exact role of attention in change blindness. Further research is therefore required to fully understand the relationship between attention and change blindness and what other factors are involved in the condition.

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