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VISUAL MASKING

In *visual masking*, a visual stimulus called the “target” becomes less visible due to interactions with other stimuli, called “masks.” The 19th century scientist S. Exner first discovered masking in the visual system. The birth of visual masking was an artifact in one of Exner's studies of consciousness. He had been trying to determine the shortest flash duration necessary for a bar of light to be visible. As a control condition, he presented two identical bars in different places of the visual field and at different times, expecting that they would be perceived as identical in appearance. Exner was surprised to find that this was not, in fact, so. Under certain specific timing conditions, the first bar was rendered invisible by the presentation of the second bar.

In masking experiments, the target and mask can be presented simultaneously, the mask can be presented before the target (“forward masking”), or the mask can be presented after the target (“backward masking”). Figure 1 illustrates backward masking. In this example, the target is a single bar that is visible when presented alone (Figure 1a). The masking stimulus is two bars that could potentially flank the single bar (Figure 1b). When the target stimulus is presented first, and then is immediately followed by the masking stimulus, the target stimulus is rendered invisible (Figure 1c). Because the mask is presented after the target, the effect operates as if the brain's

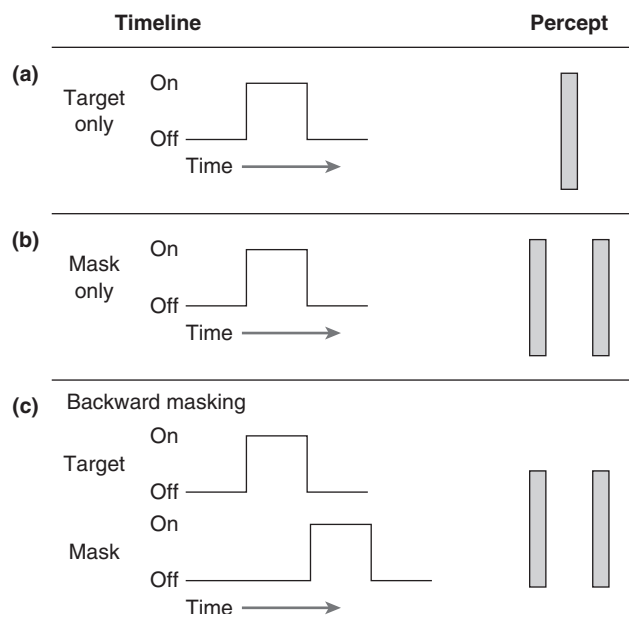


Figure 1 Description of the Perception of a Target and Mask With Respect to Temporal Arrangement

Notes: (a) The target presented alone appears as a single black bar. (b) The mask presented alone. (c) When the target is presented first, followed by presentation of the mask, the target is not visible (it has been masked) so all that is seen is the masking stimulus.

response to the mask somehow catches up to the brain's response to the target so as to inhibit the target's response and suppress the target's visibility. Moreover, when the target and mask are presented simultaneously, there is little or no masking, suggesting that the brain mechanisms that cause masking involve some sort of time-delay system. Thus, masking can occur in some conditions when the target and mask overlap each other spatially and/or temporally, or in other conditions when they do not overlap each other either temporally or spatially. The specific spatiotemporal conditions that lead to masking are important to understand because their neural correlates are critical, presumably, to understanding the neural basis of visibility and perception. Masking can therefore be used to examine the brain's response to the same physical target under varying levels of perceptibility.

Stephen L. Macknik

See also Vision: Temporal Factors

Further Readings

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VISUAL MEMORY

Visual memory can be defined as the maintenance and processing of visual information after the source of that information is no longer available to the visual system. More than a store, visual memory can be considered as an encoding system for storing and retrieving information in a format that is inherently visual (i.e., retaining some of the original properties generated at the moment of sensory or perceptual processing), and therefore different from other formats, such as the verbal one. For example, whereas verbal information is more often encoded with a semantic (expressing the meaning of the verbal information) or phonological code (expressing the sound of the words), visual information is inscribed and retrieved from memory in the form of images and/or visual features. Evidence for the existence of a visual code in memory comes from various sources: the existence of detailed visual memories in nonhuman primates, the ability to discriminate between large numbers of complex abstract fractals that are semantically meaningless; the high precision of stored sensory information, necessarily involving the representation of visual features; the findings that patients with occipital brain lesions (affecting visual cortices) might have a specific visual memory deficit, whereas patients with mediotemporal lesions (affecting “memory” areas) might have spared visual memory abilities; and finally, brain imaging studies showing the involvement of visual areas in visual memory tasks.

However, visual memories do not always have the form of mental images (mental representations of a visual object or a visual scene, accompanied

by an experience that significantly resembles the experience of perceiving an object, event, or scene, but that occurs when the relevant object, event, or scene is not actually present to the senses). Their format can range from visual images to more abstract, nonimagistic kinds of representations (although still “visual,” that is, coding visual characteristics), depending on the type of visual memory and on the level of processing. As with other memory systems, a taxonomy of visual memory can encompass three different areas: visual sensory memory (VSM), visual short-term memory (VSTM), and visual long-term memory (VLTM). This entry discusses each of these in turn.

Visual Sensory Memory

VSM (also called iconic memory) is an extremely brief type of visual memory (during less than half a second) able to store accurate information about the perceived image. It reflects visual processing at early levels of the visual pathways (between the retina and the visual cortices) and is not influenced by attention of will. It decays gradually and autonomously, although it is subject to interference (masking) due to visual items presented in close temporal proximity (e.g., 100 milliseconds delay) at the same or close locations.

VSM can be divided in two categories: visual persistence and informational persistence. Visual persistence is a picturelike representation that reflects the phenomenological experience of fading of a visual image that lasts longer than the actual stimulus duration (such as the persistence of a flash of a camera in the dark). Visual persistence is involved in visual integration of successive images, optimal for intervals shorter than 150 milliseconds, and is due to the residual activity of neurons at early stages of visual processing, from photoreceptors in the retina to neurons in the primary visual cortex (V1).

Informational persistence instead pertains to the possibility of extracting visual information after the visual stimulus has been removed, lasts longer than visual persistence, and reflects the decaying of activity of neurons at the level of striate and extrastriate visual cortices.

How much information can be stored in VSM? When observers are asked to report a large amount of information displayed for a brief time (say a