

Inattentional Blindness: Perception or Memory and What Does It Matter?

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COMMENTARY ON: A. Mack and I. Rock. (1998). *Inattentional Blindness*. MIT Press. 288 pp. ISBN: 0262632039. Price: \$US 25 pbk.

ABSTRACT: An extensive research program surrounding a phenomenon called *inattentional blindness* is reported by Mack and Rock (1998) in their book of the same name. The general conclusion that is drawn from the work is that no conscious perception can occur without attention. Because the bulk of the evidence surrounding inattentional blindness comes from memorial reports of displays, it is possible that inattentional blindness reflects a problem with memory, rather than a problem with perception. It is argued here that at least some instances of inattentional blindness are better characterized as memorial failures than perceptual failures. The extent to which unattended stimuli fail to engage perceptual processing is an empirical question that the combination of inattentional blindness and online measures of processing can be used to address.

1. Introduction

Imagine that a close friend of yours has been overseas for many years and is now returning. You are watching at an airport gate for her to emerge from the crowd of arriving passengers. You are not exactly sure what she will look like these days, so you carefully scrutinize each entering passenger for signs of a familiar expression or gesture. Now imagine that just as your friend walks through the doorway and you realize it is she,

another person in the milling crowd does a back flip upon sighting his own anxiously awaited party. Do you think you would notice the back flip?

Upon description of this scenario, most of us probably feel as though we would of course notice such an unusual and salient event. Recent research described in Mack and Rock's (1998) book *Inattentional Blindness*, however, suggests that because we were so intent on our own friend's arrival, and we were not expecting anything dramatic to occur in the background, we might very well miss the back flip. More generally, their research suggests that we consciously experience only those objects and events to which we directly attend. That means that the vast majority of information in our field of vision goes unnoticed. Missing a back flip at an airport gate might be disappointing, but missing a child in the path of your car because you are carefully focussing your attention on other cars is a much more important (and more likely) situation.

The evidence surrounding this phenomenon, which is known as *inattentional blindness*, comes from an experimental method developed by Mack and Rock, and their colleagues, which was aimed specifically at tapping into how much information is processed when that information is truly unattended. The general method - referred to hereafter as the *inattention method* - involves a demanding primary task. A common one used in their studies was the presentation of a plus sign, for which subjects were to report whether the horizontal or vertical bar was longer. The difference in length was quite small so that the discrimination was difficult. Also, the displays were flashed only briefly (e.g., 200 ms) to ensure that subjects had time to attend only to the plus sign. Subjects would complete about three trials of this task, and then on the next trial - the *inattention trial* - some additional visual event was introduced into the visual field. For example, a bright filled-in square might appear in the vicinity of the plus sign. After subjects completed the length judgment for that trial, the experimenter would ask the subject if he/she noticed anything else in the display on that last trial? Subjects would often report that they saw nothing besides the plus sign. Furthermore, when told that there was a little square somewhere in the display and were asked to guess where in the visual field it appeared (e.g., which of four quadrants), subjects were often at chance at reporting the location of the additional stimulus. This chance performance indicated that they really had no knowledge of the additional stimulus in the display. Importantly, once aware of the possibility of these additional stimuli, subjects were able to see them and were able to report where they had appeared. This is important because it means that the additional stimuli were sufficient to be perceived, as long as attention was allocated to them.

Mack and Rock, and their colleagues discovered a striking array of visual events to which people are inattentionally blind. For example, they found that not only did subjects fail to notice bright filled-in squares that appeared near to where their eyes were focussed, they also failed to notice the same salient stimuli when they appeared right at fixation. Many subjects were also unable to report anything about otherwise salient grouping or texture patterns (e.g., black and white stripes made up out of black and white dots) that appeared in the background along with the primary plus-sign task. Again, this was true despite the fact that these patterns were easily reported once subjects attended to them.

The book is presented as a story of the unfolding research program surrounding inattention blindness. Included in this story is a description of the abandonment of early conclusions that perceptual processing does not occur without attention (Mack, et al., 1992; Rock, et al., 1992) and the subsequent adoption of the alternative conclusion that there is "...no conscious perception without attention..." (Mack & Rock, 1998; p. ix). The term perception in this final conclusion is used "...to refer to the *conscious awareness* of some object or event..." (italics in original, Mack & Rock, 1998; p. 227).

Because of the unfolding-story format, if one were to read the book in bits and pieces, or if one were to consider the earlier research articles without full consideration of the monograph, one could be misled regarding the significance of inattention blindness for theories of visual perception and attention. One reason for this potential confusion is that the question of whether the phenomenon is due to limitations in perceptual processing, as the language of the book suggests, or is instead due to limitations in memory, as a viable interpretation of the data suggests, is left unresolved. It is argued here that inattention blindness is more appropriately classified as a memorial limitation than as a perceptual limitation. Two consequences of it being classified as memorial, rather than perceptual, emerge. First, it is made clear that inattention blindness presents no difficulties for theories of perception that assume preattentive perceptual processing. Second, this classification reveals inattention blindness as a promising tool for probing how stimuli in unattended portions of the visual field are processed, both perceptually and otherwise.

2. Is Inattention Blindness a Problem with Perception or Memory?

As noted by Mack and Rock from their early papers forward, there are two potential classes of explanation for the phenomenon of inattention blindness. On the one hand, it may reflect a basic failure of perceptual processes to be engaged by unattended stimuli as argued in their early papers (Mack, et al., 1992; Rock & Mack, 1994; Rock, et al., 1992). On the other hand, it may reflect a failure of memorial processes to encode information about unattended stimuli, as others have argued (Moore & Egeth, 1997; for a related view see Wolfe, 1999). Notice that under this second alternative, the failure is not attributed to subjects having forgotten something that they had encoded, and then somehow lost access to in the few seconds between the presentation of the display and the query about the display. Rather, the failure is attributed to the information having never been encoded in the first place.

The reason that inattention blindness is open to both classes of explanation - perceptual and memorial - is that under the basic inattention method, subjects are asked to report what they saw only after the fact. That is, subjects were queried about what was in the critical display only after the display disappeared, and often after the primary task was completed. Failure to report what was in that display, therefore, could equally well reflect

a failure to have encoded the information when it was available as it might reflect a failure to have perceptually processed the information.

Consistent with the interpretation of inattention blindness as a memory problem, Mack and Rock (1998) summarize in chapter 8 of their book a number of studies in which stimuli to which subjects were inattentionally blind nonetheless primed responses to subsequently presented stimuli. These priming effects indicate that at least minimal representations of the unattended stimuli were established. Because priming effects are observed after the presentation of the stimuli in question are no longer present, however, they could have arisen from post-presentation processing of only trace representations of the stimuli. Thus it is still possible that inattention blindness does reflect a failure of unattended stimuli to engage perceptual processes, and only after they are attended are the trace representations developed.

To more strongly rule out memory as the source of failure, a measure of what processing occurred at the time that the display was present is necessary, an "online" measure if you will. In chapter 9 of their book, Mack and Rock (1998) describe a series of experiments that incorporated an online measure of processing that could potentially assess the memory explanation of inattention blindness. Specifically, they sought to test whether a square to which subjects were inattentionally blind could nonetheless support apparent motion or, alternatively, the perception of two objects, when presented in the context of a second square that was presented a short while later, and to which subjects would not be blind. If it could, then that would suggest that the first square was perceived, and that the failure to report it under the inattention method might indeed reflect a failure to have encoded it in memory. Only 5 out of 20 subjects in one experiment and 5 out of 18 subjects in another experiment reported seeing motion or two objects. However, subjects not only failed to report the presence of the critical stimulus, they also failed to report the presence of the second, potentially motion-inducing, stimulus. Therefore this particular online assessment in the end could not function as an arbiter of the perception versus memory question.

Mack and Rock argue that because subjects were inattentionally blind to the motion or dual-object displays in the experiments just described, one memorial explanation of inattention blindness could be ruled out. That is the hypothesis that they refer to as the "fleeting perception" explanation, which is that subjects had fleeting phenomenal awareness of the stimuli, but failed to encode this experience in memory and for that reason were unable to report anything about them. Note that this is only one, fairly strong, version of how memory failure might account for inattention blindness. The version embraced in this commentary is that some subset of perceptual processes is engaged by unattended stimuli, but that the outputs of those processes require attention to be encoded into memory for subsequent report. What the relevant subset of processes is then becomes an empirical question. This explanation is mute with regard to whether or not subjects phenomenally experience the stimuli. It is possible, for example, that phenomenal awareness depends on encoding in memory, which in turn requires attention.

The apparent-motion/dual-object online measure used by Mack and Rock was inconclusive with regard to assessing the memorial explanation of inattentional blindness described here. Moore and Egeth (1997), however, used a different online measure and found evidence favoring a memorial interpretation of inattentional blindness at least for patterns of Gestalt grouping by similarity, the topic of chapter 2 in Mack and Rock (1998). We found that presenting in the (unattended) background of displays grouping-by-similarity patterns that formed the inducing portions of simple geometric illusions (the Ponzo and Muller-Lyer illusions) could bias reports of line length. These biased judgements were taken to indicate that subjects did at some level suffer the illusion, and therefore that grouping-by-similarity into the inducing patterns did occur. In contrast to this evidence of grouping from the online measure, when assessed by explicit report using the inattention method, subjects were unable to report anything about the patterns. Thus, they were inattentionally blind to the Gestalt patterns, despite experiencing perceptual consequences of them. More recently, Moore, Grosjean, & Lleras (2000) have provided similar evidence regarding the perceptual completion of surfaces to which subjects were inattentionally blind.

In summary, priming effects, and more strongly online measures, favor the interpretation that inattentional blindness at least sometimes reflects a failure to encode information in memory, rather than a failure to perceptually process unattended stimuli. Further studies will be required to identify the entire class of processes (perceptual and perhaps others) that are engaged by unattended stimuli.

3. What Does It Matter?

Is it simply a matter of semantics to question whether inattentional blindness is attributable to a problem with perception or to a problem with memory, as was suggested in one review of the book (Yantis, 1999)? One might ask this especially in the light of the fact that, as noted above, Mack and Rock (1998) intended "perception" in their conclusion to encompass only conscious awareness. If conscious awareness depends on memorial encoding, then the whole question of perception versus memory would seem to melt away.

There are a number of reasons that failing to make the distinction between a perceptual limitation and a memorial limitation is, in this instance, a problem. First, the combination of the story format of the book, with the continued reference to a perceptual limitation, affords a misinterpretation of the significance of inattentional blindness for theories of perception and attention. For example, because it is still early in the story, nothing is said in chapter 2, in which inattentional blindness to Gestalt grouping patterns is reported, to indicate that grouping does in fact occur preattentively, though subjects have no memory of it (Moore & Egeth, 1997). Indeed, it is implied that not only the data presented in that chapter, but later data as well support the claim that organization processes, like grouping, require attention:

"One of the goals of our research was to determine what acts of perception can occur without attention. We thought that if there were any such acts, the organization of the visual field would certainly be among them. ... Although the evidence presented in this chapter *and throughout this book challenges this assumption*, there is obvious force to the argument that some segregation of the retinal input ought to precede the activation of attention if only to provide it with an object." (p. 27; italics not in the original)

Instead of providing an indication that this interpretation will require a qualification concerning the awareness of organized patterns versus the formation of organized patterns, a bleak picture for models that include preattentive organization of displays is painted in statements like the following:

"This result would appear to underscore the conclusion that these kinds of grouping, which for so long have been assumed to occur automatically, that is, preattentively, in fact require the active engagement of attention." (p. 34)

Once the story has unfolded, and one finds oneself in the concluding chapter of the book, it is stated clearly that the conclusion is "...not that no perceptual object can exist preattentively, but only that no conscious perceptual object can do so...and that the object to which attention is directed or by which it is captured is an object of implicit - not explicit or conscious - perception." (p. 227). In light of this final conclusion, it is unfortunate that the earlier statements quoted above were not eliminated, or at least qualified by referring to this final conclusion, which renders them unfounded.

Another reason that the distinction between a perceptual and memorial limitation is important is that limiting the language of perception to "conscious awareness", which is what allows the retention of a perceptual interpretation of inattentive blindness, is awkward at best and misleading at worst. The language is awkward because it makes phrases like "unconsciously perceived" (p. 229) and "implicit perception" (p. 233) impossible by definition, yet they are still used to qualify what preattentive processing does occur. Worse than being awkward, the language may be misleading in that affords misstatements of the following sort, which are in the concluding chapter and preface of the book, not in the earlier portions of the unfolding story:

"Moreover, our data has not only led us to reject the concept of preattentive vision and preattentive search, but has also led us to reject the related notion that its products form the basis for the engagement of focused attention" (p. 242)

"This rules out the possibility of conscious preattentive perception and is at odds with the claim that these kinds of perceptions do occur (e.g., Treisman, 1980; Julesz, 1984)." (p. 241)

"The single most important lesson is that there seems to be *no conscious perception* without attention. Given the explosion of work in the last decade on preattentive perception, this is a provocative claim." (p. ix; italics in the original)

These are misstatements in that nothing about inattentional blindness requires a rejection of the notion that attention is engaged by the products of preattentive processing, as the statement quoted earlier would seem to acknowledge ("..the object to which attention is directed or by which it is captured is an object of implicit...perception" p. 227). Similarly, nothing about inattentional blindness requires a rejection of theories like those of Treisman and Julesz. Finally, nothing about the lack of *conscious perception* is provocative with regard to claims surrounding preattentive components of visual processing models. Preattentive need not, and never did need to be, conscious; in fact, Neisser (1967), for one, specifically stated that it was not.

Claims of the sort quoted here may simply be misstatements or miscitations that were made in an effort to summarize a complicated set of results. I believe, however, that it is the continued classification of inattentional blindness as a perceptual limitation, rather than a memorial limitation, that affords such statements. In particular, classifying inattentional blindness as memorial would make it clear that it presents no difficulties for theories that include a preattentive processing component. Moreover, it would liberate phrases like "unconsciously perceived" and "implicit perception" from being internally inconsistent and phrases like "conscious perceptual object" from being redundant, as they are within the context of a domain in which "perception" refers only to awareness, and inattentional blindness reflects only limitations in perception.

4. Conclusions

The phenomenon of inattentional blindness is striking. That people fail to consciously experience information that has not been attended is important; receiving "credit" for having processed the back flip at the airport gate (or the child in front of your car), for example, is scant compensation for having phenomenally missed it. Something definitely fails to occur without attention. I believe that what often fails, however, is the encoding of information into memory. I am not in a position to say that all perceptual processes occur without attention. Some instances of inattentional blindness may reflect a failure of memory, and others may reflect a failure of perceptual (or other) processing. That is an empirical question that can be answered through the combination of assessing for inattentional blindness to stimuli and simultaneously seeking online measures of specific processing. This may be a promising new approach for probing the processing of unattended stimuli, as my colleagues and I suggest elsewhere (Moore, Grosjean, & Lleras, 2000).

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