

Inattentional Blindness: Reply to Commentaries

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REPLY TO COMMENTARIES ON: A. Mack and I. Rock. (1998) *Inattentional Blindness*. MIT Press. 288pp. ISBN: 0262632039. Price: \$US25 pbk.

Three phenomena, Inattentional Blindness (IB), the Attentional Blink (AB), and Change Blindness (CB), each of which has been attributed to inattention, have been vigorously investigated in the last several years. One of the questions that has arisen in connection with all of them is whether they are failures of perception or memory, and this question is raised by Moore in this symposium. In her commentary she argues, in opposition to the claim made in *Inattentional Blindness* (Mack & Rock, 1998), that the deficit produced by inattention is one of memory and not of perception. However, her argument is not that the failure of memory is one of rapid forgetting of an object that has actually been seen as Wolfe has argued (1999), but rather that the memory failure is one of failing to encode the object in the first place. While it is not clear that it is possible to operationally differentiate between rapid forgetting and a failure to encode (if so, then as has been noted many times before, this would be a difference that makes no difference), the evidence that the critical stimulus in inattention displays which is neither detected, (observers claim to have no awareness even of the presence of anything other than the cross if that happens to be the object of attention), nor can be selected from a very limited array of possible items is capable of priming is powerful evidence against this analysis. Evidence that the critical stimulus primes a subsequent response attests to its encoding. (In fact, priming is the procedure of choice for determining whether a stimulus has been encoded.) Thus it cannot be the case, as Moore is arguing, that inattentional blindness is the consequence of a failure to encode the unattended object. Moreover, evidence of

semantic priming by these stimuli (Mack & Rock, 1998) means that these stimuli are not simply encoded at a low level of analysis, but are encoded after very high level processing. Oddly Moore writes that, "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." What is odd is that we, and I suspect most others in the field, take this as evidence of the processing of unattended, unseen stimuli, whereas she counts this as evidence of a memory failure.

Before going further it may be useful to briefly restate my argument which is summarized in the concluding chapter of *Inattentional Blindness* since it is relevant to several of the commentaries as well as to Moore's. The argument made there to which I continue to subscribe is that inattention produces a failure of conscious perception. Nevertheless, the unattended stimuli to which subjects are "functionally blind" are perceptually as well as cognitively processed. They are parsed, grouped and semantically analyzed, and produce an implicit percept which is then encoded into an implicit memory store. In other words, this percept, which has no presence in conscious awareness, is encoded into a memory store to which there is no conscious access and thus can only be revealed through priming. The argument goes on to maintain that it is the implicit percept and only the implicit percept that is capable of capturing attention, and it does so on the basis of its meaning. If the implicit percept captures attention, it then becomes an explicit percept, that is a conscious percept. If not, it remains, for how long we do not know, as an implicit memory.

I agree with Moore and others that the term *implicit* or *unconscious* perception is awkward and I am in no way wedded to it, but what I am wedded to is the view that this *implicit percept* is fully processed, is capable of capturing attention, and will do so, if it is highly meaningful to the observer when it is viewed under conditions of inattention. In arguing this, it must be patently clear that I am in no way denying preattentive processing. In fact in the book the critique, for example, of Pop Out procedures, was not that they failed to reveal preattentive processing, but rather that they failed to reveal preattentive perception, that is perception without attention. So what the awkward term *implicit perception* is meant to capture is the sense that stimuli that are not objects of attention benefit from full, preattentive, perceptual and even semantic processing, and are encoded into memory, but are not and never were represented in consciousness. This simply is not conveyed by describing the consequence of inattention as a failure of memory. However, in the end and most importantly, my sense is that Moore and I are in essential agreement and disagree only about what to call what happens under conditions of inattention. In fact, her important study (Moore & Egeth, 1997) provides corroborating evidence of the preattentive analysis and grouping of the background stimuli which is not consciously perceived but, nevertheless, does affect on the judgment of line length.

There are at least three other reasons for rejecting the argument that inattention produces a kind of amnesia rather than a kind of blindness. The first is that the question of whether inattention causes a failure of memory rather than of perception was directly addressed in a series of experiments described in Chapter 9 of *Inattentional Blindness*, none of which

produced any support for a memory account. (Rather than redescribing this work here, the reader is referred to the chapter.) Another reason for rejecting the memory claim resides in the connection between IB, the Attentional Blink, Change Blindness, and Visual Neglect, each of which is a phenomenon thought to be caused by inattention. In each of these phenomenon, objects that are not detected by observers because of inattention have been shown to produce priming which, to repeat, means that in each instance there is no failure of memory, but only a failure to encode the input into consciously accessible (explicit) memory. The similarity, although not complete (see Humphreys in this symposium), between the characteristics of VN and IB provide an additional reason for rejecting the memory failure claim since no one has ever even suggested that visual neglect is caused by a failure of memory. If the one isn't, the other isn't either.

Braun in his commentary takes a different tack. Instead of arguing as Moore and others have that we have misidentified and mislabeled our phenomenon as inattention-induced *blindness*, he seems ready to accept the claim that we have identified a blindness phenomenon, but argues instead that we have misdescribed and mislabeled it as an *inattention* phenomenon. He argues that the induced blindness is not caused by inattention but rather by the absence of expectation. As he himself indicates, this is an issue that also was discussed in the book, Chapter 9 also contains descriptions of a series of experiments which attempted to address the acknowledged ambiguity in our method.

The ambiguity in the method used in all our experiments stems from the fact that it has two quite independent aspects. First it engages subjects in an attention demanding task (the distraction task). Second, because the subject knows nothing about the possible appearance of an unrelated object (the critical stimulus) and does not expect one to appear, there is no intention to perceive it. Therefore it is possible that the occurrence of IB ... may be due to either or both of these factors. (p. 204)

While we did not deny, and I currently continue not to deny, the possible role lack of expectation plays in causing IB, there are good reasons for rejecting Braun's analysis, which maintains that IB is produced entirely by the absence of expectation and not at all by inattention. The principle reason for rejecting this account is that lack of expectation cannot explain the very significant increase in IB when the critical stimulus and the distraction stimulus switch positions so that the critical stimulus is at fixation while the distraction stimulus is in the parafovea (which results in an increase in IB of approximately 50%). There is no reason to think that there is any more or less expectation when this switch occurs, and every reason to believe that the increase in IB is due to the active inhibition of attention at fixation, where it normally resides, when attention must be paid to an object located some distance from fixation.

Another reason for rejecting Braun's account of IB is based on the same reasoning that led to a rejection of the claim that IB represents a failure of memory. Given the striking similarities between IB and AB, CB and VN, the fact that these other phenomena occur with no lack of expectation would seem also to rule out any explanation of IB in terms of

a lack of expectation. In each of these other cases, observers fail to perceive objects they are not only expecting, but actually are searching for. So, unless there is good reason to believe that IB is fundamentally different from CB, AB or even VN, it makes no sense to account for IB in terms of the absence of expectation. On the contrary, the close connections between these phenomena lend strong support for an account in terms of lack of attention.

Braun also comments upon the sharp difference between his conception of conscious perception and ours.

Whereas for Mack and Rock conscious access is the exclusive province of visual attention, for us the necessary condition for conscious access is merely a sufficiently rich and intense neural response. Such a response can come about either as the result of bottom up mechanisms ("visual saliency") or as the result of top-down intervention ("visual attention").

However, there is, I think, less difference between these views than meets the eye. *Visual Saliency* which he describes as a, "sufficiently rich and intense neural response," would undoubtedly capture attention and thus the fact that it produces a conscious percept seems completely consistent with the view that attention is a prerequisite for an explicit, conscious percept. However, Braun believes that, "Visual saliency results when a local feature differential prevails in a global winner-take-all competition," but in no single instance did we find that a local feature, whether it was motion, flicker or color led to detection under conditions of inattention.

Finally, Braun believes that not only lack of expectation but also familiarity plays a crucial factor in IB and points to the decrease in threshold that frequently occurs with practice in discrimination tasks, but I fail to grasp the relevance of this. All of the stimuli that served as critical stimuli in our hundreds of experiments were familiar, yet only a few were detected. In what sense is a moving or red square an unfamiliar object? And why if familiarity is critical, did prefamiliarizing observers with the actual grouping patterns used in exploring the question of whether grouping is perceived under conditions of inattention, not lead to their detection? In what sense is the word "the" or "and" less familiar than a stick figure of a person or a happy face? In what sense is "stop" less familiar than "house" or "time" which are among the most frequently appearing concrete nouns in the English language? Braun is simply wrong in asserting that, inattentive blindness occurs for synthetic stimuli that cannot be anticipated even in a general sense because it is not only "synthetic stimuli" that suffer blindness but most high frequency words in the language as well.

While this is not the place for full scale discussion of O'Regan and Noë's extremely interesting and strongly argued sensorimotor contingency theory of perception and perceptual awareness which is the basis for their discussion of IB, there is one aspect of their critique which merits a comment here. In their piece Noë and O'Regan raise a puzzle that is resolved, at least to my satisfaction, in the IB book in terms somewhat different from those invoked by Noë and O'Regan. The puzzle is this. If, as I and others have

claimed, there is no conscious perception without attention, then what serves as the object to which attention is directed? In their words, "How can you direct your attention to an unperceived feature or scene...(if) to direct your attention, you must already perceive that to which you wish to direct your attention." Noë and O'Regan resolve this apparent paradox by reminding us of the evidence that indicates that visuo-motor orienting responses may be guided by location coordinates that differ from those that govern perceived position. Milner and Goodale (1995) have presented a strong argument for a version of what used to be called the two visual systems theory, which builds in part on this kind of evidence. For example, open loop pointing (Bridgeman, Lewis, Heit, & Nagle, 1979; Bridgeman, Kirch, & Sperling, 1981; Bridgeman, Peery & Anand, 1997) or making a saccade to a target, whose position has appears to change due to an induced displacement, tends to be accurate despite its perceived displacement (Wong & Mack, 1981; Mack, Fendrich, Chambers, & Heuer, 1985) Mack, Heuer, Fendrich & Chambers, 1985). Or, to cite another example, open-loop pointing to the apices of Muller-Lyer figures tends to be highly accurate despite the misperception of line length (Mack, Heuer, Vilardi, & Chambers, 1985).

So I am in full agreement with O'Regan and Noë that, "we are perceptually sensitive to features of the environment of which we are unconscious". However, my argument goes beyond this to claim that under conditions of inattention much of the visual input is highly processed and encoded. It is this implicit perception, and, not simply information critical to visual motor responding, that if meaningful serves to capture attention, and thus is the preattentive object to which attention is directed. With this one caveat, I am in full agreement with the authors that, "nothing in these findings (i.e., the IB findings) threatens our (their) sensorimotor account."

Humphreys comments focus on the similarity and differences between IB and VN, a link I too believe is important both because it may afford a deeper understanding of both phenomena, and because, as already noted, their similarity makes the argument that IB represents a loss of memory more difficult to defend. Humphreys notes that grouping processes not only occur in the neglected field in patients with VN but also under conditions of IB (Moore & Egeth, 1997). He also notes, however, that while there is evidence that grouping affects the magnitude of extinction in neglect, there is no evidence that it affects the magnitude of IB under conditions of inattention. But as Humphreys himself correctly points out, the question of the nature of the relation between the attended and unattended stimulus has not yet been fully explored; although the Moore and Egeth study (1997) does show that the unattended stimulus can influence the attended one.

It would not be difficult, however, to begin to answer the question concerning the relation between the attended and unattended stimuli using the IB procedure. For example, it would be possible to look at what happens when the attended (distraction) stimulus is a word, for example, "dog" and the unattended stimulus is either a kind of dog (e.g., a pug), or the frequently associated word "cat", and compare the resulting IB with a condition in which the unattended stimulus is similar but unrelated to the attended word (e.g., when the unattended stimulus is either "bug" or "hat").

The more fundamental question which concerns Humphreys, namely what is it that differentiates an implicit (unreportable) percept from an explicit (reportable) percept, is surely important, and we have suggested that meaningfulness may be at least part of the story. However, Humphreys makes a different and very interesting suggestion that inattention may affect the pathway underlying perceptual report, regardless of whether that inattention is caused by VN or instructions to the observer, and leave the pathway underlying orienting responses unaffected. Noë and O'Regan might wish to reject this possibility, but it too merits investigation.

The interesting commentary by Most, et. al. significantly extends our understanding of the affects of inattention on perception, while that of Dulany essentially rejects the phenomenon of IB completely on the grounds that it is based both on extremely flawed methodology as well as on flawed phenomenology. Dulany does not believe that he is ever completely unaware of (blind to) stimuli impinging upon his retinae at least in some general way. Now while it is difficult to argue about the validity of someone else's phenomenal experience, I would like to refer him and the readers to the concluding paragraph of *Inattentional Blindness* where they will find a quote from Aristotle in which he writes, "The above assumption explains why persons do not perceive what is brought before their eyes, if they are at the time in deep thought, or in a fright, or listening to some loud noise." As to the soundness of our methodology, I will let others be the judge.

Like Dulany, Tzelgov also raises questions about our phenomenology and refers to Dulany's description of having the "feeling of" something, a state that I do not wish to deny, but which I ascribe to the operation of distributed attention that vanishes under strict conditions of inattention. In his commentary, Tzelgov argues for an analogy between the inability to report the meaning of words in a Stroop task and the failure to detect the critical stimulus in an inattention procedure, both of which he believes reflect the limitations of the representations resulting from automatic processing. While we have also argued that the stimuli to which observers are inattentionally blind are processed and encoded, I believe it is a mistake treat the failure to identify a word with the failure to detect it. Observers are not blind to Stroop stimuli. They are only unable to report their meaning. In contrast, observers are blind (unaware) of the very presence of the critical stimulus when they experience IB, and in this sense IB is a more profound perceptual failure.

In the end, one of the most interesting questions is the one raised by Humphreys regarding the difference between reportable and unreportable perceptual representations, which will be better understood by exploring the similarities between IB, VN and CB, rather than exploring the relationship between these phenomena and Stroop effects, or alternatively, by denying that the effects described by these terms are real.

References

Bridgeman, B., Lewis, S., Heit, G., & Nagle, M. (1979). Relations between cognitive and motor oriented systems of visual position perception. *Journal of Experimental Psychology: Human Perception and Performance*, 5, 692-700.

Bridgeman, B., Kirch, M., & Sperling, A. (1981). Segregation of cognitive and motor aspects of visual function using induced motion. *Perception & Psychophysics*, *29*, 336-342.

Bridgeman, B., Peery, S., & Anand, S. (1997). Interaction of cognitive and sensorimotor maps of visual space. *Perception & Psychophysics*, *59*, 456-459.

Mack, A., Fendrich, R., Chambers, D., & Heuer, F. (1985) Perceived position and saccadic eye movements. *Vision Research*, *25*, 501-505.

Mack, A., Heuer, F., Fendrich, R., & Chambers, D. (1985) Induced motion and oculomotor visual capture. *Journal of Experimental Psychology: Human Perception and Performance*, *11*, 329-345.

Mack, A., Heuer, F., Vilaridi, K., & Chambers, D. (1985) The dissociation of position and extent in Muller-Lyer figures. *Perception and Psychophysics*, *37*, 335-344.

Milner, A. D., & Goodale, M. A. (1995). *The visual brain in action*. Oxford ; New York: Oxford University Press.

Moore, C. M., & Egeth, H. (1997). Perception without attention: evidence of grouping under conditions of inattention. *Journal of Experimental Psychology: Human Perception and Performance*, *23*(2), 339-352.

Wolfe, J. (1999). Inattentional amnesia. In V. Coltheart (Ed.) *Fleeting Memories*. (pp. 71-94). Cambridge, MA: MIT Press