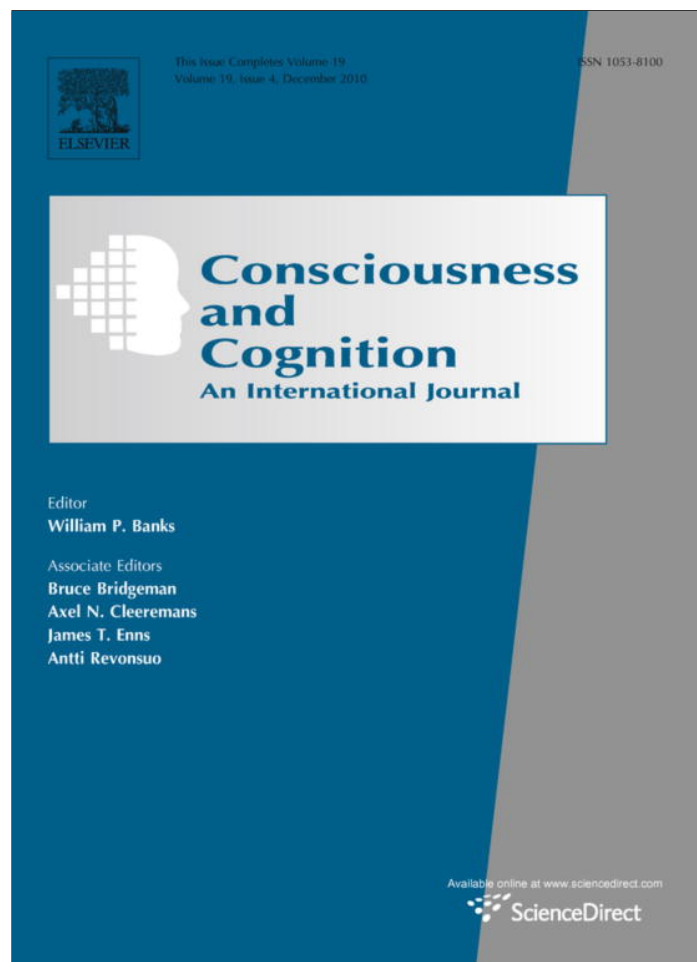


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## Consciousness and Cognition

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## Reply

Beyond inattentive blindness and attentional misdirection: From attentional paradigms to attentional mechanisms<sup>☆</sup>Daniel Memmert<sup>\*</sup>, Philip Furley

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## ARTICLE INFO

## Article history:

Received 7 May 2010

Available online 29 June 2010

## Keywords:

Overt attention

Covert attention

Working memory

Perceptual load

Representative task designs

Sport

## ABSTRACT

Memmert (2010) tried to foster the development of attentional research by discussing four differences between attentional misdirection (AM) and inattentive blindness (IB). Considering this goal, the comment was received in the intended way by the comments of Most (2010) and Moran and Brady (2010) who make a number of highly valuable suggestions for further progress. As initially suggested by Memmert (2010) this dialog should help unravel the underlying attentional mechanisms of different paradigms. Therefore, we first discuss the suggested distinction between central and spatial IB by Most (2010). Second, we argue that working memory and perceptual load research seem particularly interesting in this regard and should be taken into consideration when conducting future research along the lines of IB and AM. Third, representative task designs can be an important mosaic piece in across-the-board attention theories and highly useful for deriving further testable hypothesis in naturalistic settings. The most important claim of all commentaries in this issue is that the proposed ideas can all be empirically tested and thereby contribute to the advancement of an unified theoretical framework incorporating IB, AM in consideration of overt and covert attention mechanisms.

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## 1. Introduction

In a series of studies Kuhn and colleagues (e.g., Kuhn & Findlay, *in press*) described a novel attentional misdirection (AM) approach to investigate overt and covert attention mechanisms in connection with inattentive blindness (IB). Memmert (2010) tried to foster the development of the link between both approaches by discussing four differences between AM and IB which concern the conceptual aspects of the unexpected object and methodological aspects of the task design. The central point of the commentary of Memmert (2010) is that extreme caution is required when comparing theoretical discussions and empirical evidence from both paradigms. The main aim behind this effort was to initiate further theory development in the area of attentional research. Considering this goal, the comment was received in the intended way by the first excellent comments by Most (2010) and Moran and Brady (2010) who make a number of highly valuable suggestions for further progress. As initially suggested by Memmert (2010) this dialog should help unravel the underlying attentional mechanisms of the different paradigms. Therefore, several preliminary suggestions for future research lines incorporating IB and AM are put forth in order to study selective attention processes in more depth. Most (2010) and Moran and Brady (2010)

<sup>☆</sup> Reply to Commentaries on Most, S. B. (2010). What's inattentive about inattentive blindness? *Consciousness and Cognition*, 19, 1102–1104; Moran, A., & Brady, N. (2010). Mind the gap: Misdirection, inattentive blindness and the relationship between overt and covert attention. *Consciousness and Cognition*, 19, 1105–1106.

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elaborate on this by stating further interesting ideas and advancements of the initial ideas that are intended to bridge the gap between AM and IB. Subsequently we want to comment on the following topics to steadily promote this process.

## 2. Sub-types of IB

The differentiation of (at least) two sub-types of IB by Most (2010) which he assumes to be driven by distinct attentional mechanisms – (a) covert allocation of spatial attention; (b) distraction or preoccupation of non-spatial selection mechanisms stemming from late-stage bottlenecks – seems highly valuable, not only for providing a basis of convergence of various attention paradigms (e.g., object substitution masking; Enns & Di Lollo, 1997), but also allowing a substantial discussion of older and more current attentional frameworks. Thereby, one needs to investigate if these sub-types can be empirically separated, how many sub-types of IB actually exist and respectively integrate these in overarching attentional frameworks while considering both covert and overt attentional processes as initiated by Most (2010). Another interesting question arising from the possible distinction of central and spatial IB is whether there might be dichotomous or gradual boundaries.

Most's (2010) starting point for the distinction between central and spatial IB is the comparison of results found in Mack and Rock's (1998) static studies and results found in Most, Simons, Scholl, and Chabris (2000) dynamic monitoring task. Surprisingly Mack and Rock (1998, p. 56 and p. 69) find contrary results regarding possible central and spatial IB within their static line judging paradigm. In different conditions of their experiments a black circle (=unexpected object) appeared either parafoveally with the primary attention demanding task at fixation or at fixation with the attention demanding task in the periphery. Interestingly only 25% of the participants are inattentionally blind in the parafoveal condition (in contrast to 73% in the far condition by Most et al., 2000) whereas 89% fail to notice the unexpected object at fixation (47% in the on-line condition by Most et al., 2000). This finding is somewhat counterintuitive to Most et al. (2000) and seemingly does not support the spatial vs. central IB distinction, which is probably due to the fact that the two paradigms differ in major aspects. Therefore, these findings require further research and show that extreme caution is required when comparing results from different IB tasks. Thus, it is necessary to investigate a possible distinction within a single study.

Two bodies of literature that are addressed in the following chapter seem particularly interesting in this regard and should be taken into consideration when conducting future research along the lines of IB and AM.

## 3. Working memory and perceptual load

A recent study by Fougne and Marois (2007) linked working memory (WM) load to IB by showing that executive processing can result in IB. Referring to results by Most et al. (2001), Most, Scholl, Clifford, and Simons (2005) they conclude that both visuospatial and executive information processing can result in IB and thus support Most's (2010) distinction of central and spatial IB. When reading the distinction between spatial and central IB the long-standing debate of early (e.g., Broadbent, 1958; Neisser & Becklen, 1975) versus late selection (e.g., Deutsch & Deutsch, 1963; Tipper, 1985) views comes to mind for which Lavie (1995) put forth a possible resolution within her elegant perceptual load (PL) model. According to her model, processing proceeds from relevant to the irrelevant items until capacity runs out. Under conditions of low perceptual load spare capacity inevitably spills over and irrelevant information is processed, whereas irrelevant processing can be prevented when a high load in relevant processing exhausts capacity. Cartwright-Finch and Lavie (2007) could find evidence for the load theory using a modification of Mack and Rock's (1998) IB task. Both the studies by Fougne and Marois (2007) and Cartwright-Finch and Lavie (2007) demonstrate that attentional theory development benefit from integrating different paradigms with one another. Nevertheless, Fougne and Marois (2007) explicitly state that extreme caution has to be warranted when comparing results from different paradigms as their pattern of results appears to be inconsistent with findings from the perceptual load paradigm, which they state is due to the slight difference that in one paradigm the distractor is expected and in the other one not. Memmert (2010) makes a similar claim when comparing IB with AM. Thus, our main argument is that theory development can substantially benefit from the integration of different paradigms within a single study but one needs to be cautious when comparing results from different experimental settings. This exemplary discussion emphasizes how the integration of the IB, AM, WM, and PL paradigms can be important mosaic pieces in across-the-board attention theories and highly useful for deriving further testable hypothesis.

## 4. Representative task designs

We welcome that Moran and Brady (2010) encourage our view (Memmert, 2010) that “recent research on inattentional blindness and attentional misdirection has shown that these paradigms have great potential for the development of more differentiated attention frameworks leading to new testable assumptions of attention mechanisms”. As Moran and Brady state the field of sports seems a fruitful area for studying complex human behavior in a complex context by providing test procedures with context specific performance data (representative task designs: Brunswik, 1956; see also, Dicks, Davids, & Button, 2009). In the meantime new data (Furlley, Memmert, & Heller, 2010) could address one consideration of Moran and Brady (2010) by showing that level of expertise affected the occurrence of IB in a representative basketball task amongst adults (for expertise effects in the general IB paradigm; see also Memmert, 2006). In combination with the further proposed lines of research by Moran and Brady (2010) we think that future research can benefit from incorporating individual differ-

ence variables (such as working memory capacity, attentional capacity) in representative task designs in order to foster the illumination of underlying covert and overt attentional mechanisms.

## 5. Outlook

The most important and redundant claim of all commentaries in this issue is that the proposed ideas can all be empirically tested and thereby contribute to the advancement of a unified theoretical framework incorporating IB, AM in consideration of overt and covert attention mechanisms. All of the commentaries encourage the integration of currently isolated attention paradigms and theories. The vivid discourse in this issue appears to be a promising attempt in doing so.

## Acknowledgments

Special thanks go to Matt Dicks for many inspirations and comments on earlier versions of this commentary.

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