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Comment and Reply

Comment on Shomstein, Kimchi, Hammer, and Behrmann (2010): A case study in methodological anosagnosia?

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Shomstein, Kimchi, Hammer, and Behrmann (2010) try to capitalize on the apparent dissociation between vision and the processes that seem to mediate neglect patients' attentional selection and awareness to investigate the processing of perceptual grouping in the absence of visual attention. We argue that to assess this type of dissociation requires specific methodological adaptations to determine whether visual attention is in operation. We caution that Shomstein et al.'s article does not present convincing evidence of grouping without attentional selection because they do not directly assess attentional selection in their experimental task.

It is really no surprise that the clinical phenomenon of hemispatial neglect periodically catches the attention of cognitive scientists who are interested in the foundational question of how visual consciousness and perception interact: In neglect, there appears to be a dissociation between the two so that patients behave as if they are blind to the visual world contained in the contralesional hemifield (usually left), though it can be shown that basic vision is, in fact, largely intact. *Hemispatial neglect*, as we will refer to it here, is often caused by a stroke that damages neural tissues within several structures of the right cerebral hemisphere, often in the parietal/posterior temporal lobe area. This lesion spares primary visual cortex and most of the pathways that carry visual information to it, including most of the optic radiations originating in the ipsilesional lateral geniculate nucleus. Whether tested by the wiggle of a single finger placed at different points in the patients' visual field or by formal perimetry, it is usually possible to demonstrate that hemispatial neglect is not the result of a primary sensory deficit. Hemispatial neglect patients can often detect a simple moving finger, or blinked dots of light in the very areas of the contralesional visual hemifield that they seem not to see or use when navigating around a room, eating food on a plate, or combing their hair in a mirror. Neglect patients will rack up bruises on the left sides of their bodies, have eyeglasses with the left lens broken, knock knickknacks off of furniture to the left of their routes, and eat only from the right side of a plate, as if their contralesional visual world does not exist. Tragically, they often deny that anything is wrong, sometimes passionately so. Their "anosognosia" for these problems makes treatment and rehabilitation difficult, if not impossible.

Shomstein, Kimchi, Hammer, and Behrmann (2010) try to capitalize on the apparent dissociation between vision and the processes that seem to mediate such patients' use of visual information to investigate cognitive processes (i.e., perceptual grouping) in the absence of visual attention (i.e., using hemispatial neglect patients as participants). As we will review below, this simple dissociation is not the nature of hemispatial neglect. On the basis of patients' performance across two tasks, Shomstein et al. conclude that "perceptual grouping" occurred without attention or awareness. Although this may be true under certain circumstances, it cannot and should not be drawn from the data presented.

Our point of contention rests on the validity of Shomstein et al.'s (2010) critical claim that the congruity effect observed on their sequential matching task occurred without "attentional selection." This is a questionable assertion because assessment and determination of patients' attentional selection abilities was based on a completely different task (i.e., the "attentional cuing" task) from the one used to infer the influence of perceptual grouping. There are two reasons why one cannot be confident that evidence of attentional selection provided by one task may be used to infer the level of attentional selection in another. First, the relationship among tasks sensitive to neglect tends to be highly variable and often weak; and second, neglect itself tends not to be uniform across the neglected field, especially if the tasks are not equally sensitive to symptoms.

The literature is full of examples of the psychometric variability among measures of neglect. Different standard neglect measures vary greatly in sensitivity (Azouvi et al., 2002), in how they covary, and in their consequent factor structure (Azouvi et al., 2002; McGlinchey-Berroth, Bullis, et al., 1996). For example, Azouvi et al. examined the correlations among typical clinical measures of neglect (e.g., line bisection, cancellation), finding correlations that ranged from as low as $r = .10$ (for figure copying vs. 5-cm line bisection) to $r = .78$ (for naming of overlapping figures vs. reading) with a mean correlation (between the Bells test and other measures) around $r = .56$, suggesting only about 30% common variance. Furthermore, in a study of 120 patients with hemispatial neglect, McGlinchey-Berroth, Bullis, et al. found groups of patients who performed poorly either on line bisection or on search tasks but not on both, indicating that impair-

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ments can occur on one task independently of the other. For their claim to be valid, one would have to assume that in the Shomstein et al. (2010) study, the sensitivity to attentional selection in the cuing task was less than or equal to what would have been required in order to discriminate between the grid patterns presented in the left hemifield in the sequential matching task. Unfortunately, Shomstein et al. do not assess how accurately the participants discriminated the distractor patterns presented in the cross-field condition of the sequential matching task. In order to infer a lack of attentional selection in the sequential matching task, one would have to bet that patients would perform worse on that task than on the cuing task. Such a bet would be ill advised, not only because of the issue of task variability, but also because there is reason to believe that the patients had a pretty good chance of telling whether the patterns were the same or different using intact attentional selection, as we will demonstrate below.

One of the mysteries of neglect is that symptoms can vary with the frame of reference in which attention is deployed. Some patients seem to neglect the left side of space, defined by their subjective visual midlines; some show neglect for the left side of objects even when the objects are placed to the right of midline; and some patients show evidence of visual allesthesia, transposing information present in the left hemifield into the right. These phenomena have been well documented in the literature (Marshall & Halligan, 1993) and studied experimentally (Behrmann & Moscovitch, 1994), reflecting the variability in how attention may be deployed in this patient population. Recent attempts to study the quantitative distribution of attention in neglect document not only that the likelihood of attentional selection is highly variable within the neglected hemifield, but that such selection often shows a clear gradient, with the greatest likelihood of signal detection occurring close to the midline, dropping off toward the left and bottom of the field (e.g., Chatterjee, Thompson, & Ricci, 1999; Smania et al., 1998). Deouell, Sacher, and Soroker (2005) presented a sophisticated analysis of this phenomenon measuring reaction time and accuracy to detect a small circular target presented against a changing array of distractors across the visual fields of right- and left-hemisphere stroke patients. Only for right-hemisphere patients did they find that the detection of targets could be equivalent within several degrees on either side of the central midline, with some patients detecting targets well into the left hemifield. Given these findings, one could ask whether partial access to the grids in the sequential grouping task provided enough information to allow the participants to discriminate between the stimuli, even if the entire grid was not available to attentional selection. An inspection of Figure 2 in Shomstein et al. (2010) suggests that the answer to this question is "yes"; it may be possible to distinguish between *same* and *different* trials using only the rightmost portion (next to midline) of the overall design for left hemifield grids. For the reader's convenience, Figure 1 shows occluded views of Shomstein et al.'s figures, leaving only two dots visible on the right side of the designs. It is clear that it is only necessary to see that two adjacent dots have the same or different

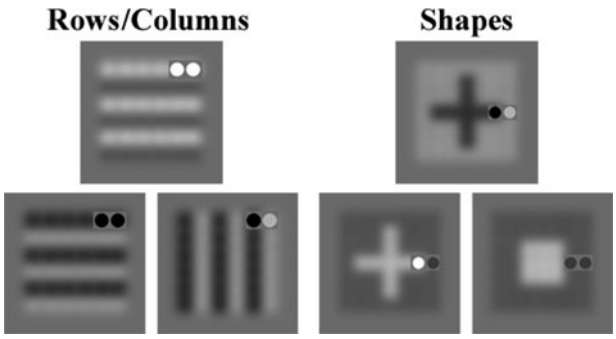

Figure 1. The arrays that are part of Shomstein et al.'s (2010) Figure 2 depicting sample stimuli used in the sequential matching task. As can be seen, it is necessary only to see the rightmost adjacent dots in the left-hemispace display to correctly distinguish the designs, even across grayscale changes.

contrast to distinguish the grids. Although the grayscale levels may change from trial to trial, the contrast between pairs of horizontally adjacent dots may have served as a cue to the condition. We assert that if the patients can attend to even a small portion of the design that proves to be sufficient to distinguish between conditions, the effects on the target cannot be interpreted as evidence of any sort of perceptual processing without attentional selection.

Nevertheless, the demonstration of perceptual processing in the "absence of attention" is not without precedent (e.g., Làdavas, Paladini, & Cubelli, 1993; McGlinchey-Berroth, Milberg, Verfaellie, Alexander, & Kilduff, 1993; McGlinchey-Berroth, Milberg, et al., 1996; Volpe, Ledoux, & Gazzaniga, 1979). There is even some evidence of the existence of what were termed "preattentive grouping mechanisms" in a study of illusory contours in patients with neglect (Vuilleumier, Valenza, & Landis, 2001). These studies had to confront the same complex clinical phenomenology using experimental methods like Shomstein et al.'s (2010), and suggest that there is some methodological redress for the issues that we have raised here. One solution is to create a control condition requiring attentional selection of the distractor grids juxtaposed to stimuli that are similar to those that were used as targets (basically reversing the task). This was the standard used in the first experimental demonstration that pictorial information in the neglected field could semantically prime lexical decision targets that were presented centrally (McGlinchey-Berroth et al., 1993). Not only was it demonstrated that patients could not reliably identify the pictures in a forced choice task presented under conditions identical to the priming paradigm, but data were presented showing that patients with actual visual hemifield deficits did not prime. In the context of the Shomstein et al. study, if patients cannot make same/different judgments at a level greater than chance and still show a congruency effect on the main task, the authors will have a convincing demonstration that grouping can occur without attention. Until then, the acceptance of these data as evidence of grouping without attentional selection would require a kind of anosagnosia to methodological detail on the part of the reader. Hemispatial neglect can, indeed, provide a window into the complex interaction be-

tween consciousness and visual perception. However, such investigation requires extraordinarily careful attention to the inherent sophistication of the visual system to adapt to natural and experimental challenges. It is imperative when using hemispatial neglect as a model for normal processing without awareness that investigators be mindful across the entire methodological space.

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