

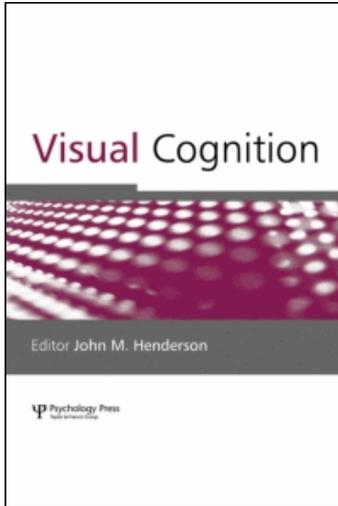
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## A New Look at Functions of Attention

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Commentary on “Selection for Cognition: Cognitive Constraints on Visual Spatial Attention” by Gordon D. Logan and N. Jane Zbrodoff

The article by Logan and Zbrodoff presents an important perspective on perceptual attention: A primary function of perceptual attention is to generate propositional representations to support cognition (selection for cognition). Other functions of attention (selection for perception, selection for action) are treated more cursorily.

*Selection for Perception.* In the first modern theory of attention, the filter theory of Broadbent (1958), perceptual attention was a mechanism for selecting one of many kinds of sensory stimuli and allowing the selected kind of stimuli to be processed by a limited-capacity system for perceptual categorization. Thus, perceptual processing capacity was regarded as a limited resource, and perceptual attention as a mechanism for allocating the capacity to selected inputs to the system. Attentional selection of inputs was “selection for perception”, and it protected the limited-capacity system from informational overload. Many theorists since have retained the perspective of selection for perception and the notion that the system for perceptual categorization is limited in processing capacity.

Logan and Zbrodoff acknowledge that selection for perception is an important aspect of attention, but they criticize the notions of processing resources and capacity limitations: “We do not think of attention in terms of resources or capacity limitations . . . The energy metaphor that underlies those ideas appears to be theoretically bankrupt” (p. 59, this issue).

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Logan and Zbrodoff's rejection of the notions of processing resources and capacity limitations seems too rash. The notions need not be based on energy metaphors. Perceptual processing resources are neural mechanisms, and capacity limitations can be measured in units of elements per second. This is done, for example, in the fixed-capacity independent race model (FIRM) for selection from multi-element displays (Shibuya & Bundesen, 1988). FIRM is based on the assumption that a fixed amount of processing capacity is distributed among display elements in proportion to their attentional weights. The amount of processing capacity that is allocated to an element determines how fast the element can be encoded into short-term memory. This model has yielded accurate accounts of the way in which the probability that a target can be reported depends on the duration of exposure and the numbers of targets and distractors in the display.

*Selection for Action.* Visually guided actions are typically directed against one or a few objects at a time. Hence, regardless of any limitations in our capacity for processing of perceptual information, some selective process is necessary to map the visual representation of just the target objects onto parameters controlling the action. Allport, Tipper and Chmiel (1985) called this process "selection for action". Allport et al. argued that attentional selection is selection for action and not selection for perception. Logan and Zbrodoff reply that selection for action and selection for perception are equally important aspects of attention.

*Selection for Cognition.* The main contribution of the article by Logan and Zbrodoff is the account of selection for cognition. The authors argue that perceptual attention in humans supports cognition by generating pertinent propositional representations of perceptual objects and situations. For example, object identification is interpreted as the formation of an explicit propositional representation that asserts "object  $x$  is a member of category  $i$ ".

Logan and Zbrodoff suggest that simple perceptual categorizations about elementary stimulus features involve simple, single-step attentional routines. I suppose such routines can be based on (a) comparison of the stimulus object with memory representations in the form of feature lists, templates or structural descriptions, and (b) weighing of the resulting strengths of evidence for particular categorizations by bias and priority parameters (see Bundesen, 1990; Logan, 1996). Logan and Zbrodoff claim that feature lists and templates are not adequate representations of objects: "Feature lists and templates fail because they are not compositional representations" (p. 61). However, I cannot see why simple perceptual categorizations about elementary stimulus features should require comparison against composite representations.

Finally, Logan and Zbrodoff propose that more extensive attentional routines are required for more complex perceptual categorizations about combi-

nations of features or spatial relations between objects. Important examples of more extensive, multi-step attentional routines are found in Logan's work on interpretation of spatial cues and apprehension of spatial relations (Logan, 1995; Logan & Sadler, 1996). The article by Logan and Zbrodoff provides a stimulating summary and a valuable new perspective on this work.

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