



Commentary

Beyond perception: Testing for implicit conceptual traces in high-load tasks ☆

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ABSTRACT

The present commentary addresses the main results obtained in the Butler and Klein [Butler, B. C., & Klein, R. (2009). Inattention blindness for ignored words: Comparison of explicit and implicit memory tasks. *Consciousness and Cognition*, 18, 811–819.] study and discusses them in relation to the Perceptual Load Theory of Lavie [Lavie, N. (1995). Perceptual load as a necessary condition for selective attention. *Journal of Experimental Psychology: Human Perception and Performance*, 21, 451–68.]. The authors claim that the use of implicit indexes of conceptual distractor processing in high-load situations would be an important addition to the load literature, which would benefit the research field regardless of their positive or negative findings.

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1. Commentary

Butler and Klein (2009) report an interesting study in which they show that words presented as distracters in a high-attentional load task are processed at least up to the perceptual level. This result contrasts with the previous null findings that have been reported using the same inattention blindness task (Rees, Russell, Frith, & Driver, 1999). At the same time, they provide evidence that the perceptual quality of irrelevant information can be processed in at least some high-load situations. This result qualifies the Perceptual Load framework proposed by Lavie (Lavie & Tsai, 1994), and merits further investigations.

The evidence in support of the Perceptual Load theory is overwhelming (see Lavie, 2005). It has been repeatedly shown that, compared to low-load situations, high perceptual load eliminates the behavioral interference effects exerted by distracters irrelevant to the task. The bulk of this evidence stems from the use of several variations to the response competition paradigm (Eriksen & Eriksen, 1974). In addition, studies employing neuroimaging methods have shown that the activity in brain areas related to distractor processing is reduced when the load of the relevant task is increased (although see Ruz, Wolmetz, Tudela, & McCandliss, 2005; Ruz, Worden, Tudela, & McCandliss, 2005, for counter-evidence). These and other results have been taken to indicate that high perceptual load excludes distractors from early perceptual processing (Lavie, 2005), as claimed by classic early-selection theories (Broadbent, 1958).

In comparison with previous studies, the advantage of the design chosen by Butler and Klein is the use of *implicit* memory tasks to evaluate distractor processing. This type of behavioral tests has been mostly absent from the studies that have gathered null evidence to support the lack of distractor processing in high-load situations. Yet, as suggested by Butler and Klein's

☆ Commentary on Butler, B. C., & Klein, R. (2009). Inattention blindness for ignored words: Comparison of explicit and implicit memory tasks. *Consciousness and Cognition*, 18, 811–819.

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research, although explicit indices of performance are strongly affected by perceptual load, it could be the case that some implicit approaches are able to unveil traces of distracter processing in these contexts.

The published studies that so far have explored the relation between perceptual load and implicit processing have offered mixed results. Whereas some authors have reported that task difficulty has strong effects on implicit learning (e.g. Rowland & Shanks, 2006), others have claimed that implicit indexes such as repetition priming are not affected by task load, in contrast to explicit tests (Jenkins, Burton, & Ellis, 2002). In their paper, Butler and Klein show that the presentation of words as distracters in a high-load inattention blindness task benefited their subsequent identification. They labelled this test 'Perceptual Identification task', as the task of the participants was to try to name out loud briefly presented and then masked stimuli. They also included another implicit task labelled 'Category Association task', which aimed at testing whether the semantic representation of the distracter words had been accessed. Unfortunately, the latter did not show evidence of semantic processing, either for the ignored or the attended words.

The results by Butler and Klein show that the perceptual representation of words is accessed even when they are presented as distracters in a high-load situation. In addition, although their 'Perceptual Identification' task relies heavily on perceptual processes, performance may have even been boosted by higher-level representations of the words, such as their semantics. The absence of comparison stimuli that lack these representations, such as pseudo-words or non-words, prevents from evaluating this possibility. Importantly, this study opens a host of new questions, which could serve as a springboard to launch future research in this area. In the first place, the category association task that they used to probe conceptual processing may not be sensitive enough, as suggested by some aspects of the data. On average, participants only reported 20% of the words in this task, which is a quite low percentage compared to the 80% reported in the 'perceptual' task.¹ Moreover, the conceptual task did not offer any proof that even the *attended* words activated their semantic representation. This result is at odds with the good explicit recognition memory for attended words, and also with the neuroimaging reports showing that attended words in this task activate brain areas related to semantic processing (Rees et al., 1999; Ruz, Wolmetz, et al., 2005; Ruz, Worden, et al., 2005). Thus, as Butler and Klein themselves acknowledge, other *conceptual implicit* tasks should be tried to probe the extent to which distracter words may be able to activate their semantic representations in high-load situations. Potential candidates could be masked or unmasked semantic priming in lexical decision or similar tasks, or false alarm indices to lures semantically related to ignored and attended words (see Bentin, Kutas, & Hillyard, 1995).

Some hints that implicit conceptual processing of words might occur under high-load and inattention blindness conditions can be found in a study published by Fuentes, Carmona, Agis, and Catena (1994), although their procedures deviate from the ones usually employed in the load literature. In a lexical decision task, both foveal and parafoveally-presented distracter words produced significant semantic priming effects, although the size of the priming was larger for the former than for the latter. When the task was performed simultaneously with an auditory shadowing task, priming from the attended words decreased significantly, but it was still significant. Priming from distracter words, on the other hand, was *not* affected by the secondary task. This procedure resembles a high-load situation. Experiment 2 used a masking procedure that resembled an inattention blindness situation. In this case, the authors observed that when the prime words were masked, semantic priming was reliable for both foveal and parafoveal words but there were no differences between them. In addition, the size of priming was similar to that obtained from parafoveal words in Experiment 1. Taken together, these results suggest that conceptual processing occurs when words are presented at fixation but attention is allocated to a difficult competing task (e.g., shadowing), or when masking prevents their conscious identification.

For several decades, the level of representation at which irrelevant information is filtered out of the cognitive system has been the battlefield between early (Broadbent, 1958) and late (Deutsch & Deutsch, 1963) selection theories, a debate that the Perceptual Load framework claims to have solved (Lavie, 1995). The evidence provided by Butler and Klein showing that implicit measures are able to demonstrate perceptual processing of distracters in high-load situations is clearly a step forward. However, a much stronger test would come from the use of sensitive implicit tasks for evaluating the conceptual processing of ignored information in these situations. Results obtained with studies using a variety of implicit approaches would benefit the research field regardless of their positive or negative findings. They could represent an additional test of the perceptual load theory by using a type of measures that have not been exploited in this literature. The perceptual load theory would be considerably strengthened if several sensitive implicit measures were unable to find traces of conceptual activation of ignored stimuli in high-load situations. On the other hand, positive findings of implicit conceptual traces (like those reported in our previous studies, Fuentes et al., 1994; Ruz, Wolmetz, et al., 2005; Ruz, Worden, et al., 2005) in these or similar contexts could serve to qualify the theory, and to advance our understanding of how task demands route the resources and brain systems engaged by target and distracting stimuli.

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¹ This low percentage is, however, within the normal range of sensitivity of similar conceptual memory tasks, as reported in previous studies (e.g. Hunt & Lamb, 2006; Light & Albertson, 1989; Mulligan, 1997).

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