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Reply

Consciousness might still be in business, but not in *this* business[☆]

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ABSTRACT

In a recent comment on our paper *Implicit Working Memory* (Hassin, Bargh, Engell, & McCulluch, 2009) Guterman (2010) argued that a possible interpretation of the results of one of our experiments is that “conscious awareness ... enabled the participants to find ways to benefit from the predictability ... while nullifying the cost.” Unfortunately, the data do not support this interpretation. Additionally, Guterman (2010) seems to have suggested that our results may be explained by non-working memory processes. We argue against this interpretation.

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Throughout our paper (Hassin, Bargh, Engell, & McCulluch, 2009) we used a new paradigm to examine implicit working memory. Participants are asked to make quick perceptual discriminations regarding disks that appear on the screen (they could be either full, or bagel-shaped). The disks appear in sets of five, and there are three within-subject conditions. In pattern sets, all the locations of the disks in a set follow a pre-determined pattern; in Broken Pattern (BP) sets, the first four disks follow the patterns, whereas the fifth does not (thereby “breaking” the pattern). In control sets, the locations of the first three disks are randomly determined, whereas disks 4 and 5 follow the patterns. Crucially, participants’ task is very easy, perceptual, and has nothing to do with locations. Based on analyses of the functions of WM it was our contention that extraction of the patterns is working memory-based, and we provided data that RTs to BPs were longer than those for pattern sets, with control sets following somewhere in between. Across all experiments, we found no evidence for intention to extract the patterns, or awareness of them. We therefore suggested the existence of implicit working memory.

Guterman’s comment focuses on Experiment 4, and towards the end of his comment he discusses the nature of our paradigm. We will refer to both points, in turn. Guterman (2010) examined the results of Experiment 4 that included a condition in which participants were told about the existence of the patterns (explicit condition) and a condition in which nothing was said about these patterns (implicit condition). The results of the latter condition were 514 ms for pattern sets, 547 ms for control, and 566 ms for BPs. The results of the explicit condition were 508 ms for pattern, 511 ms for control, and 519 ms for BPs.

Based on these results Guterman argues that “conscious awareness of the existence of patterns in the displays enabled the participants to find ways to benefit from the predictability associated with complete patterns while nullifying the cost associated with the Broken Patterns or the controls.” Alas, the results do not support this interpretation. First and foremost, there is no significant (or close to significant) effect for pattern in the Explicit condition ($p > .34$). Second, even if one disregards this null effect and continues to examine the differences between each pair of conditions – none of them reaches significance (all $ps > .23$). Thus, statistically speaking, these results are actually a flat line, and hence cannot support Guterman’s conclusions.

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Participants in the explicit condition seem to be faster overall, thus suggesting that awareness of the existence of patterns may speed up performance. Are conscious working memory/executive functions in business here, as Guterman seems to suggest? There are two points to note. First, the main effect of condition is not significant ($p > .2$), and hence cannot support Guterman's interpretation. Secondly, even if this effect were significant, it would not have suggested a role for awareness because the workings of working memory are only evident in differences between control, pattern, and BP conditions. In contrast, changes in *overall speed* that, by definition, are not sensitive to the patterns, may have been caused by various factors such as increased motivation, changes in perceived norms, or increased motor preparedness (to name just a few), all of which seem to be more parsimonious than the planning, monitoring and strategy evaluation suggested by Guterman (2010) [to re-iterate, we are interpreting non-significant results here].

Lastly, Guterman argues that the paradigm we developed requires "little involvement of the central executive" (p. 654). The most central point in this argument, as we see it, is his third point, in which he argues:

... Indeed, as Hassin points out, there had to be temporal integration of the consecutive disk locations into recognizable configurations. However, it should be noted that the stimuli within each set were visible for 500–550 ms each and were separated by 150 ms intervals, making each set last about 3.5 s. At the same time, sets were clearly demarcated from each other by 1500 ms intervals (for an interval/set length ratio of 42%). Thus temporal integration could have relied on powerful bottom-up cues which only minimally called for the involvement of higher order working memory functions. (p. 654)

While we completely agree with the description and premises, we do not see how the conclusion follows, and Guterman (2010) does not suggest how such integration can take place without working memory and executive functions. Crucially, "little involvement" (p. 654) of the central executive outside of conscious awareness is all it takes to argue that the central executive may operate outside of conscious awareness. The detailed investigation of the various functions of working memory, and how efficiently they operate in conscious vs. implicit working memory, is a task for future research.

We thank Guterman for reading our paper so carefully. It is always nice to know that at least one reader does. Yet, we conclude that while consciousness might still be in business (this was Guterman's title, although we never argued that it is not), it is not in *this* business. Whether the unconscious can or cannot (as Guterman argues) think – whatever the term *thinking* may be referring to – is still an open, fascinating, and central question in the cognitive sciences.

References

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