Temporal expectation may affect the onset, not the rate, of evidence accumulation

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In their recent article, Rohenkohl et al. report data showing that increased temporal expectation, caused by rhythmic structure in the stimulus sequence, leads to increased accuracy and reduced response times to targets embedded in the sequence. The main goal of the authors was to determine how increased temporal expectation improved the quality of sensory information: by speeding up early stimulus encoding (prior to the decision process), enhancing the rate of evidence accumulation, or (less likely given the observed data) a change in decision threshold. Rohenkohl et al. fit their data with a Palmer diffusion model and found that the improved performance could be accounted for by an increased evidence-accumulation rate, but not by a reduction in the time needed for stimulus encoding or a change in decision threshold.

However, recent studies using sequential-sampling models (including Ratcliff's diffusion model; Jepma et al., 2012) and other methods (Bausenhart et al., 2010; Seibold et al., 2011) have shown that in other paradigms the performance benefits of increased temporal expectations are due to a reduction in the time needed for stimulus encoding (so that evidence accumulation can start earlier), not to a change in evidence-accumulation rate. The discrepancy between these earlier results and those of Rohenkohl et al. calls for an explanation.

A plausible explanation is that the use of the Palmer diffusion model, and in particular its formula describing accuracy, is inappropriate for tasks as that used by Rohenkohl et al., in which the duration of evidence accumulation is limited through backward masking of the target. Under such conditions, a reduction in encoding time (due to increased temporal expectation) acts to lengthen the time available for accumulating evidence, and, consequently, may lead to an increase in accuracy. This scenario is not within the purview of the Palmer diffusion model. Hence, we believe that the diffusion model analysis of Rohenkohl et al. may not be able to discriminate between an early onset and a higher rate of evidence accumulation. Additional work using non-masked stimuli is required to assess the extent to which the results from Rohenkohl et al. are truly inconsistent with earlier work.

References:
Jepma, M., Wagenmakers, E.-J., & Nieuwenhuis, S. (2012). Temporal expectation and information processing: A model-based analysis. Cognition, 122, 426-441.

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Bausenhart, K. M., Rolke, B., Seibold, V. C., & Ulrich, R. (2010). Temporal preparation influences the dynamics of information processing: Evidence for early onset of information accumulation. Vision Research, 50, 1025–1034.

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Reply of Rohenkohl et al:
http://www.jneurosci.org/content/32/24/8424/reply#jneuro_el_110372

Unpublished reply of Nieuwenhuis et al.:
We agree that it is possible that not all temporal expectation effects reflect the same underlying mechanism and that this may account for the discrepancy between different paradigms. We also agree that our use of the term backward masking was a bit unfortunate. However, we remain concerned about Rohenkohl et al.'s use of nonstationary stimuli in combination with the Palmer diffusion model:

By referring to Smith and Ratcliff's (2009) theory and their estimate of 200-300 ms, Rohenkohl and colleagues are essentially saying that their stimuli, although nonstationary, were presented long enough for the formation of a durable short-term memory (VSTM) trace, and that the diffusion process could operate on the VSTM trace in the absence of the actual stimulus. However, it is our impression that in Smith and Ratcliff's theory, the problem of determining whether increased attention results in an early onset or increased rate of evidence accumulation is moved from the decision process to the preceding VSTM formation process. For example, in their abstract Smith & Ratcliff write: "The VSTM trace encodes the transient outputs of early visual filters in a durable form that is preserved for the time needed to make a decision. Attention increases the efficiency of VSTM encoding, *either by increasing the rate of trace formation or by reducing the delay before trace formation begins*."
Thus, we are concerned that even after incorporating Smith and Ratcliff's assumptions, the model of Rohenkohl et al. cannnot distinguish between these two accounts.