Confirmed and Violated Predictions Benefit Long-Term-Memory

Regine Bader (Saarland University), Samira Engels (Saarland University), & Axel Mecklinger (Saarland University)
regine.bader@mx.uni-saarland.de

It is widely acknowledged that predicting up-coming information plays a pivotal role in online language comprehension. However, the down-stream effects on the retention of this information on the long run have been less thoroughly explored. On one hand, schema-based memory theories suggest that predicted information is remembered more effectively as it aligns with prior knowledge, i.e. existing schemas (van Kesteren et al., 2012). Alternatively, if information merely confirms a prediction, it may be processed more superficially leading to weaker retention (Hubbard et al., 2024). On the other hand, unpredicted information may be particularly memorable because it generates prediction errors (PE; van Kesteren et al., 2012). PEs signal a shift in the processing context, potentially prompting an update of the current situation model, thereby serving as a cue for learning. Research on the mnemonic consequences of confirmed and disconfirmed predictions in language comprehension has yielded mixed findings (Haeuser & Kray, 2022; Höltje & Mecklinger, 2022; Hubbard et al., 2024). These inconsistencies may be addressed by comparing memory for both predicted and unpredicted information with an appropriate baseline condition. In such a baseline, only minimal predictions should be possible, thus avoiding both confirmation and violation. Moreover, for long-term retention it might make a difference whether prediction violations are still plausible or anomalous as only the former might lead to an update of the situation model. In our study, participants engaged in two study-test blocks. In the study phases, they read brief two-sentence statements with the sentence-final word of the second sentence (target) being either expected, unexpected but plausible, or completely anomalous. Of note, the sentences also varied in their degree of constraint: some were strongly constraining (1), while others were only weakly constraining (2). In the weakly constraining sentences, participants were unlikely to form predictions about the target. Therefore, these sentences constitute an appropriate baseline.

(1) (a) The birthday party was over, and Helene wanted to go home quickly. She ordered herself a taxi. (expected)
(b) The birthday party was over, and Helene wanted to go home quickly. She ordered herself some food. (unexpected)
(c) The birthday party was over, and Helene wanted to go home quickly. She ordered herself a pillow. (anomalous)

(2) (a) Mathilde knew exactly what she wanted to do next. She ordered herself a taxi. (matched to SC expected)
(b) Mathilde knew exactly what she wanted to do next. She ordered herself some food. (matched to SC unexpected)

After a 3 minutes retention interval, participants discriminated between previously presented target words and new words. Preliminary analyses (n=33) (Fig. 1) indicate that both predicted and unpredicted targets, whether plausible or anomalous, were remembered better than unexpected targets presented in weakly constraining sentences. These results align with the idea that both schema congruency and PE contribute to the long-term retention of information encountered during language comprehension.

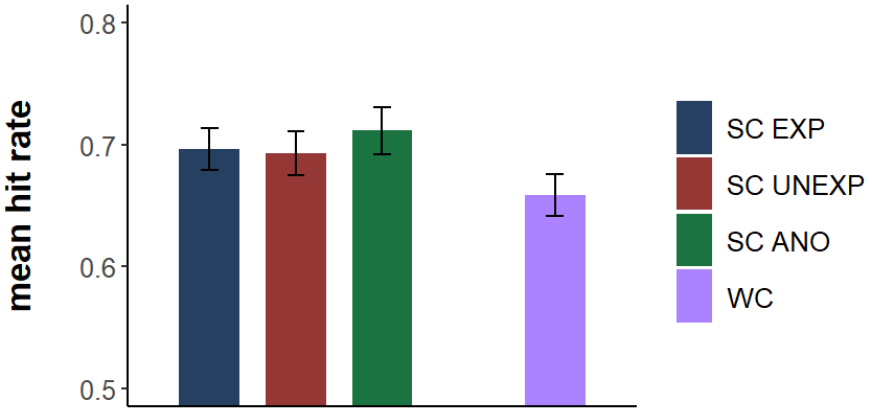

Figure 1. Mean hit rates for targets in the strong constraining expected (SC EXP), strong constraining unexpected (SC UNEXP), strong constraining anomalous (SC ANO), and weak constraining (WC) conditions. WC hit rates are averaged across both types of targets. Error bars depict the standard error of the mean difference.

References

Haeuser, K. I., & Kray, J. (2022). How odd: Diverging effects of predictability and plausibility violations on sentence reading and word memory. *Applied Psycholinguistics*, *43*(5), 1193–1220. https://doi.org/10.1017/S0142716422000364

Höltje, G., & Mecklinger, A. (2022). Benefits and costs of predictive processing: How sentential constraint and word expectedness affect memory formation. *Brain Research*, *1788*, 147942. https://doi.org/10.1016/j.brainres.2022.147942

Hubbard, R. J., & Federmeier, K. D. (2024). The Impact of Linguistic Prediction Violations on Downstream Recognition Memory and Sentence Recall. *Journal of Cognitive Neuroscience*, *36*(1), 1–23. https://doi.org/10.1162/jocn_a_02078

van Kesteren, M. T. R., Ruiter, D. J., Fernández, G., & Henson, R. N. (2012). How schema and novelty augment memory formation. Trends in Neurosciences, 35, 211–219. doi:10.1016/j.tins.2012.02.001