Behavioral and Electrophysiological Tests of a Perceptual Account of Negative Priming

Xing Tian (xtian@psyc.umd.edu), Eddy J. Davelaar (edavelaar@psyc.umd.edu), Todd Crowley (crowley@umd.edu)
Department of Psychology, University of Maryland
College Park, MD 20742 USA

David E. Huber (dhuber@psy.ucsd.edu)
Department of Psychology, University of California, San Diego
La Jolla, CA 92093 USA

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A Perceptual Account of Negative Priming

Negative priming is the observation of slower (or less accurate) responses to targets that were previously ignored. Current explanations emphasize inhibition or interference at post-perceptual processing stages. Our alternative perceptual account is based on the empirical finding that repeating a stimulus leads to perceptual deficits for that stimulus (e.g., Weidemann, Huber & Shiffrin, 2005). Negative priming experiments typically involve a one-to-one mapping between stimuli and response (e.g., naming), and cannot differentiate between response effects and perceptual effects. Instead, we used a same/different task, allowing separation of perceptual effects from response effects.

Behavioural Results

In a series of experiments we investigated the differential contributions of perceptual and response-related processes in a same/different judgment task. All experiments involved cue words immediately followed by target words that were either different or identical. Cues or targets repeated across trials to produce the priming conditions. Experiment 1 examined response withholding by using a go/no-go task in which participants pressed a key whenever the target was different than the cue. Experiment 2 used same/different judgments on every trial. According to our account of perceptual discounting, priming the cue helps performance (magnifies the difference between cues and different targets) whereas priming the target harms performance (reduces the difference between cues and different targets). These effects were found for both experiments, demonstrating the robust nature of these perceptual effects across different response demands. We modeled these results with a simple dynamic neural network by including perceptual discounting as implemented with transient synaptic depression due to recent activity.

MEG study of same-different task

We predicted benefits for cue priming and deficits for target priming under the assumption that the basic process was novelty as calculated from the additional activation to a different target. In our account, immediate familiarity (same trial) is found through the absence of the novelty response. In order to test these claims, we measured examined electrophysiological response during the same/different task (Experiment 3). Like EEG, Magnetoencephalography (MEG), gives millisecond temporal resolution for cortical activation, but additionally yields higher spatial resolution for the underlying cortical sources. Therefore, we used MEG to separately assess magnitude differences between immediate novelty and familiarity as well as differences in the underlying processes as inferred from spatial differences. We found that the early perceptual response (M170) to the target was greater when the target was different than the cue, as expected from our Novelty account of the data. Despite this magnitude difference, the spatial layout of the M170 response was identical for both trial types, indicating that the same cortical areas were involved for immediate novelty and immediate familiarity.

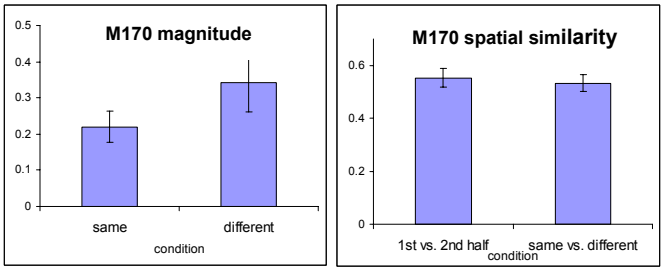

Figure 1: the M170 proportion for same and different conditions; and cosine value between M170's in within and between conditions.

Acknowledgments

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References

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