Knowledge Exerts Dissociable Effects on Target and Distractor Processing in Binocular Rivalry

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Abstract

The ability to filter out distractors is crucial for effective sensory processing. Since the world is rarely random, prior knowledge can guide selective attention. Using a binocular rivalry paradigm combined with steady-state visually evoked responses, we investigated the neural dynamics of target and distractor processing. Behavioral enhancement was observed in the target-cueing condition, with no significant cost in the distractor-cueing condition. Single-trial analysis revealed that the distractor-related cost was mitigated by the complementary roles of parietal alpha and frontal theta. Specifically, prominent frontal theta activity during the rivalry phase indicated reactive control, reducing the distractor's sensory strength. Additionally, prior knowledge of distractors induced strong parietal alpha activity, reflecting pre-tuning of the attentional gate, which stabilized the target signal and blocked the distractor without affecting sensory gain. Our results reveal a dual mechanism for resolving visual competition, highlighting the distinct yet cooperative roles of parietal alpha and frontal theta.

In D. Barner, N.R. Bramley, A. Ruggeri and C.M. Walker (Eds.), *Proceedings of the 47th Annual Conference of the Cognitive Science Society*