Spatial modulation of feature-based interaction between working memory and perception

Content in working memory (WM) has been shown to interact with attentional selection (e.g., Olivers, Meijer, Theeuwes, 2006) and alter perceptual processing (Teng & Kravitz, 2019) in a stimulus-specific way, potentially through the shared recruitment of sensory cortices for perception and WM maintenance (sensory recruitment model; D'Esposito & Postle, 2015; Postle, 2015). Here, we directly tested the spatially specificity of the interaction between WM and perception with a psychophysical task. We predict that if a feature maintained in WM is retinotopically organized, its influence on perception would be spatially specific; alternatively, if WM activates feature channels globally in a similar manner as feature-based attention, its influence would not be constrained by location. In a dual-task paradigm, participants were first presented with two orientations on each side of the display and were instructed to memorize one of them. While holding the orientation in mind, they performed a secondary orientation discrimination task on another orientated stimulus and then reported the memorized orientation at the end. The discrimination stimuli in the secondary task could either match or mismatch the location and orientation of the memory stimuli. The contrast of the discrimination stimuli was systematically manipulated to derive the contrast threshold. We found that WM boosted the perceived contrast of the orientation-matching discrimination stimuli only when their locations also matched. The threshold was significantly lower in the location-match and orientation-match condition than the other conditions. Further, shifting attention away from the memory location had a detrimental effect on memory precision, indicating that location mismatch might disrupted the context-binding process in WM. These results suggest that 1) there is a spatially specific representation of WM that influences early stage perceptual processing; 2) spatial context is an important determinant of the strength of WM.

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