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Cross-Category Effects in Spatial Working Memory

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Introduction

Most models of memory and spatial categorization predict that people select relevant categorical information at the time of stimulus encoding (e.g., Huttenlocher, Hedges, & Duncan, 1991). Following encoding, unselected category information has no influence on subsequent memory and categorization responses. In contrast, the Dynamic Field Theory (DFT), a neural network model of spatial working memory, suggests that unselected information can still exert an influence following encoding (Schutte, Spencer, & Schöner, 2004). In particular, the network's activation continues to be affected by “unselected” categorical information during memory delays.

To investigate this issue, memory targets were placed in separate spatial categories, but close to a category boundary (e.g. to the left and right of the midline axis of the task space). Participant's experience with the targets was varied by changing the relative frequency of trials to each target. The critical question concerned whether or not the longer-term memory of items in the unselected (e.g., right) category would affect memory for items in the adjacent (e.g., left) category during memory delays. If the predictions of the DFT are correct, such cross-category interactions would be expected.

Method

Participants were seated at a table with a homogeneous surface in a dimly lit room. Two dots aligned with the table's vertical axis were presented 15cm to right of midline. Previous work has demonstrated that these dots form a salient reference axis in spatial recall tasks (Simmering & Spencer, 2004). A target appeared for 2s and participants were asked to recall the location after delays of 0, 10, or 20s. We examined performance in four conditions: no bias (targets -5° to the left of the axis and 5° to the right of the axis), bias right (targets at -5° and 5° with twice as many trials to 5°), plus 10 (targets at -5° , 5° , and 10°), plus 80 (targets at -5° , 5° , and 80°). Importantly, participant's experience responding to the left (-5°) target was the same in all conditions.

Results

According to the DFT, performance to the left target should differ across conditions based on the frequency and spatial distribution of targets in the unselected, right category. This is precisely what we found. Repeated and different exposures to targets in the right category exerted

significant effects on responses to items in the left category, even though the number and type of trials to items in the left category was identical across all conditions.

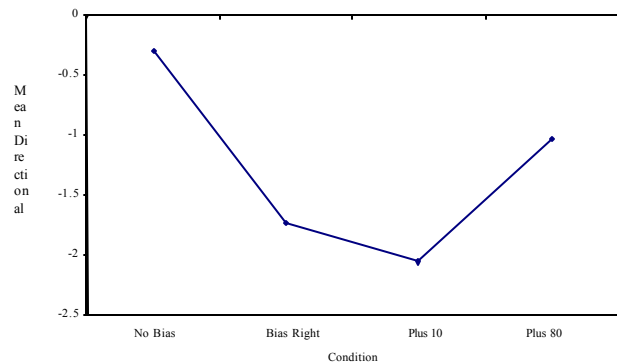


Figure 1: Directional error at the left target across conditions. As predicted, Bias Right and Plus 10 differs significantly from No Bias.

Discussion

Our results are consistent with the proposal that information from both selected and unselected categories can exert an influence on spatial memory performance. Current studies are examining these cross category effects more closely. For instance, the DFT predicts that memory biases to the left target should vary systematically with the distance between the left and right targets.

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