

What kind of space is remembered in spatial span?

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Background

Spatial span is a commonly used STM task in which a sequence of locations are shown and the participant recalls these by pointing to them in the correct order. The locations are defined by a fixed number of square blocks randomly placed within a rectangular frame (the template). Typically in spatial span the template remains stationary with respect to the observer, and hence it is unclear what spatial reference frame is used to specify the locations. The reference frame could be egocentric, screen-based, or a template-centred allocentric description, or a combination. Moving the template with respect to the observer at different phases of the task can be used to distinguish these possibilities.

Method

The observer sat in front of the display and was told to keep still during the experiment. On each trial 7 locations were displayed at a 1s rate, followed by recall using the mouse. In the first series of experiments, the template moved unpredictably around the screen during presentation or during recall, or it moved during a retention interval of 7 s. In a second series of experiments, movements of the template were coordinated with the sequence of locations such that (a) the egocentric/screen position was constant over trials, but template position varied, or (b) the same sequences were displayed on the template, but egocentric/screen position varied across trials.

Results

Series 1. When the template was moved during input there was a marked decrease in accuracy relative to the condition where the template remained stationary. However, there was little or no interference when the template moved during output, or during the retention interval.

Series 2. There was no evidence of learning across trials when egocentric/screen position was held constant across sequences. However, when template sequences were held constant, rapid learning took place.

Conclusions

The results from series 2 shows that by the end of a trial, locations are encoded in a template-centred reference frame, and egocentric reference frames make no further contribution. According to this interpretation, Hebb learning in spatial span is entirely template-centred.

However, memory was severely impaired when the template moved during input. This may be because an egocentric reference frame is used only during encoding, during which it is sensitive to a change of position. After encoding, the location sequence is template-based, and hence resistant to movements of the template itself.

An alternative explanation is that movement of the template produces shifts of attention during encoding that interfere with spatial STM, a claim commonly made in spatial working memory. These two accounts are not necessarily distinct if the effects of movement interference or other types of spatial distraction on spatial memory acts selectively through common reference frames.

