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Keeping track of objects while exploring an informationally impoverished environment: Local deictic versus global spatial strategies

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Abstract

This study investigates a new experimental paradigm called the Modified Traveling Salesman Problem (Bullot & Droulez, submitted). This task requires subjects to visit once and only once  $n$  invisible targets in a 2D display, using a virtual vehicle controlled by the subject. Subjects can only see the directions of the targets from the current location of the vehicle, displayed by a set of oriented segments that can be viewed inside a circular window surrounding the vehicle. Two conditions were compared. In the "allocentric" condition, subjects see the vehicle move across the screen and change orientation under their command. The "egocentric" condition is similar except for how the information is provided: the position and orientation of the vehicle icon remains fixed at the center of the screen and only target directions, as indicated by the oriented segments, change as the subject "moves" the vehicle. The unexpected finding was that this task can be performed, in either condition, for up to 10 targets. We consider two possible strategies that might be used, a location-based strategy and a segment strategy. The location-based strategy relies on spatial memory and attempts to infer the locations of all the targets. The segment strategy is more local and focuses on the directional segments themselves, keeping track of the ones that represent already-visited targets. A number of observations suggest that the segment strategy was used, at least for larger numbers of targets. According to our hypothesis, keeping track of the segments requires one to use indexical reference for associating the segments with their status in the task - given by current status predicates Visited( $x$ ) or Not-visited( $x$ ) -, perhaps using visual indexes (Pylyshyn, 2001), deictic pointers (Ballard et al., 1997), or object files (Kahneman et al, 1992).

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