Using Virtual Reality Environments to Assess Context Segmentation and Spatial Memory Performance using a 2D and Virtual Reality Test Environment

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Virtual Reality (VR) has been identified as a useful tool in neuropsychological evaluation thanks to its increased control and measurement capabilities over other methods (Schultheis et al, 2002). More recently, evidence shows that along many measures, VR provides similar ecological validity to real environments (Kuliga et al, 2014). One area of research which is particularly amenable to VR paradigms is learning and memory. Previous work has suggested that context-boundaries have a selective effect on sequential binding of information and, therefore, item relationships which span contexts should show segmentation effects when compared to within-context items (DuBrow & Davachi, 2013). In this study, a VR spatial navigation task with four contexts (colored rooms) was constructed to evaluate how judgements of item pair locations within a context differ from pairs which cross contexts. During the task, subjects were instructed to explore their environment (beginning from pseudo-random positions and orientations) and study locations of all items before being tested on a 2D map and in a VR environment. Measurements of subject position, orientation, and memory for item locations were assessed across four trials. The data show significant increases in performance (speed, efficiency of movement/orientation, and memory accuracy) across successive training/test trial as well as significant difference in distance between within-context and across-context item pairs (with across context pairs being placed further apart and within context pairs closer together despite the pairs being equidistant). Additionally, differences between 2D and VR test paradigms showed larger segmentation effects in 2D than VR. Finally, across all trials, segmentation effects remained relatively stable in VR test while 2D test showed a significant drop in across context distances between first and fourth trials only in the 2D test. These results show that virtual reality can be used successfully in exploring spatial memory segmentation phenomena stability across multiple trials as well as provide tantalizing new measures which increase spatiotemporal resolution on behavior beyond other existing methods.