Enhancing Memory with the Method of Loci using Virtual Memory Palaces

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Introduction

- The Method of Loci (MoL) is an ancient mnemonic technique in which one encodes non-spatial information by associating it with the spatial scaffolding of a mentally imagined, familiar environment[1].
- Our pilot study with two virtual worlds found that the classic benefits of MoL remain robust in our implementation that used virtual environments as memory palaces, where subjects could view and interact with 3D objects.
- The present study follows up on this finding by: 1) adding a third virtual world 2) instructing subjects to recall the list of objects without explicitly prompting them with the world in which the objects were encoded 3) eliminating rehearsal 4) decreasing exposure time.
- We aimed to assess whether the MoL technique can be effectively deployed in a VR setting to bolster memorization of ordered sequences of items.

Three Virtual Worlds

Toon World *Lagoon World* *Ruin World*

Methods

Exploration

- All subjects (n=41) explored each of the 3 VEs twice by completing a series of token-collection tasks within each world (Figure 2).
- Upon initial visitation to each world, subjects had 5 min to collect 20 tokens scattered about the environment, using any remaining time to freely explore. Subject were then given a second opportunity to visit each world again, and this time they had 3 min to collect the tokens.
- This ensured that all subjects evenly explored each of the VEs and learned the major features and landmarks.

Methods Cont.

Exploration Phase: Token-Collection Task

Toon World *Lagoon World* *Ruin World*

Encoding

- Subjects were instructed to walk about each of the VEs as sequence of 15-to-be-remembered 3D objects were rendered in front of their avatar for 30s each (Figure 3). Subjects were told these objects belonged to one of three people: Otto, Pike, and Viola and that they would later be asked to recall the items belonging to each person in the order they were originally presented.

Encoding Phase: Placing Object at Memorable Loci

Placing a beer in Toon World *Placing a rope in Lagoon World* *Placing a basket in Ruin World*

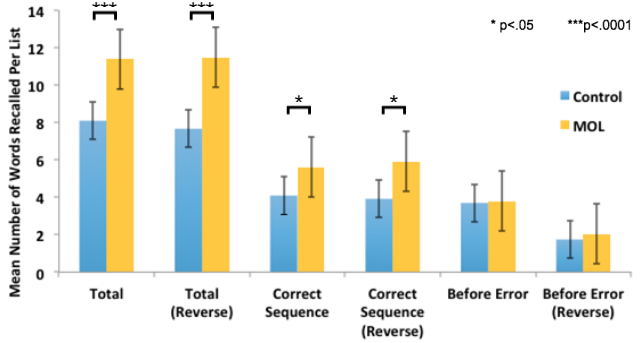
Groups

- Subjects in the **MoL group** (n=20) were briefed on the classic implementation and mnemonic benefits of the MoL and instructed to "click" on the objects to as to volitionally "place" them at locations of their choosing in the environment.
- Subjects in the the **Control group** (n=21) were not instructed to "place" the objects. Instead, they were briefed on a fabricated mnemonic technique dubbed the "Walk and Learn" strategy that extolled the benefits of learning information while navigating a spatial environment.

Recall

- Subjects were given a maximum of 2 minutes to verbally recall the list of items belonging to each person. This was done twice for each list of objects--once in the order in which the list of objects were encoded and the reverse order. All subjects were encouraged to mentally recreate the encoding context (environment and spatial proximity) to facilitate their recall.

Results



Conclusions

- Subjects in the MoL group recalled significantly more items and retained greater temporal encoding order compared to subjects in the Control group.
- Additional analyses (not shown) revealed a significant correlation between one's spatial memory capability (for landmarks and objects) and their list recall performance. This suggests that one's ability to recruit spatial encoding systems (explicitly enforced by the MoL) is intimately tied to their success at our visual object list learning task.
- This study demonstrates that the benefits of the MoL mnemonic extend beyond its classic mental imagery-based implementation. Our virtual reality learning protocol provides a proof of concept that could encourage widespread use of the MoL.
- Our future directions include plans to characterize the neurological underpinnings of MoL-enhanced recall strength, using fMRI measures of context reactivation.

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References

1) Bower, Gordon H. "Analysis of a mnemonic device: Modern psychology uncovers the powerful components of an ancient system for improving memory." American Scientist (1970): 496-510.