Memory Lane: Exploring the Potential of Vision Language Models in Memory Tasks

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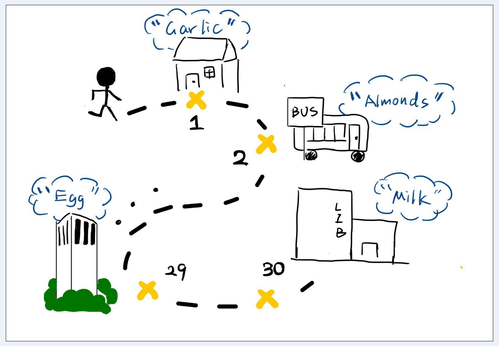
What is Method of Loci (MoL)?

- Also known as the **Memory Palace Technique**
- How to use MoL to memorize a sequence of items:
  1. Choose a path you know by heart (e.g. commute to school)
  2. Associate each item in the sequence (e.g. “egg”) with a memorable location (e.g. Storke Tower) along this path
  3. Recall the sequence by mentally walking through your “memory palace”



Pros:

- Leverages the human sense of direction
- More effective than other memorization techniques
- Great for long term recall

Cons:

- Difficult for new users
- Mapping process is creatively intensive
- Aphantasia (disorder where one can’t form mental images)

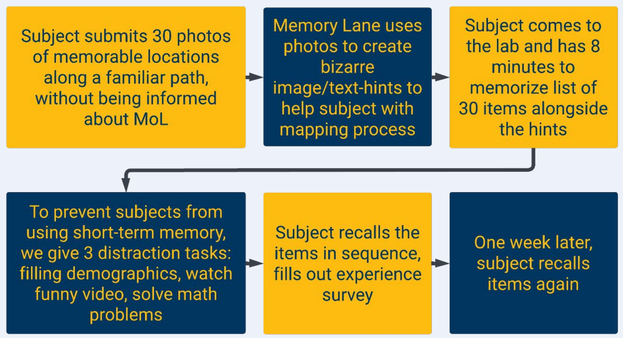
Problem / Solution

Problem: MoL is unappealing due to the tediousness during the mapping process.

Solution: We aim to study how Large Language Models (LLMs) can make this process more fun and memorable and improve upon the effectiveness and appeal of MoL.

Human Subjects Study Design

We created Memory Lane, an app that uses GPT-4 to generate wacky image/text hints to help make the mapping process more appealing for users of MoL.To explore its effectiveness, we designed the following human subjects study:



Memory Lane

GPT-4

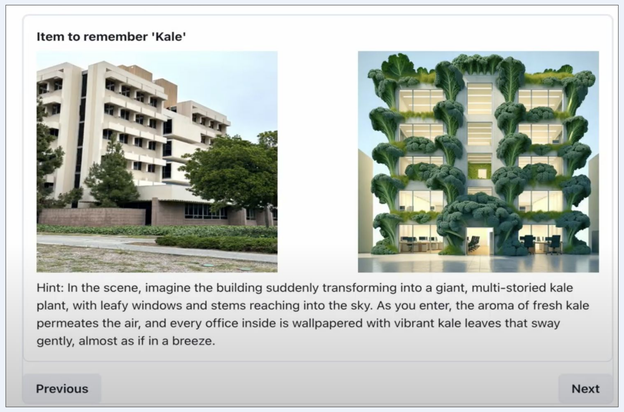
“Help me memorize **spaghetti**”

Sample text output: At the Tesla charging station, a whimsical Italian chef is twirling electric cables like strands of spaghetti around his fork, serving up "energy pasta" to the delight of eco-conscious drivers. Each car gets a "taste" of the sustainable sauce as it plugs in, with the chef exclaiming, "Buon appetito, to your car!"

Experimental Groups (A / B / C)

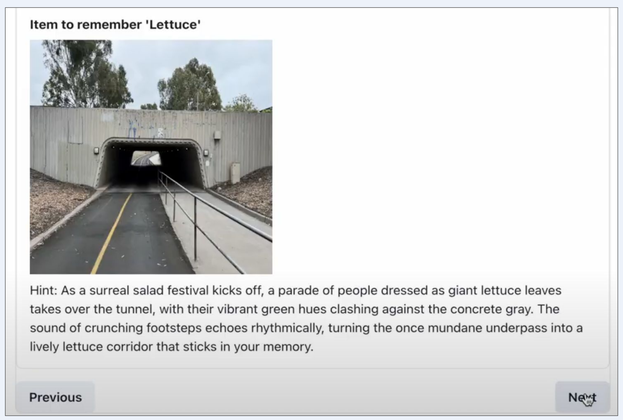
Group A
(Text + Image Hints)

vs. Control:
Short Term: **-26.28%**
Long Term: **+19.23%**



Group B
(Only Text Hints)

vs. Control:
Short Term: **-21.32%**
Long Term: **+19.23%**



Control Group
(No Hints)

Results

Memory Recall Scores

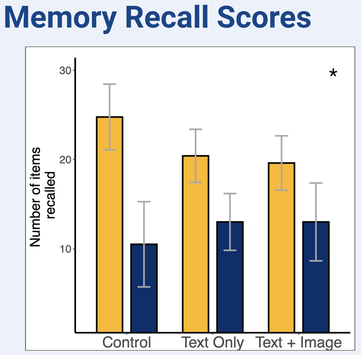


Figure 1: Instant vs Week-after scores for number of items correctly recalled out of 30.

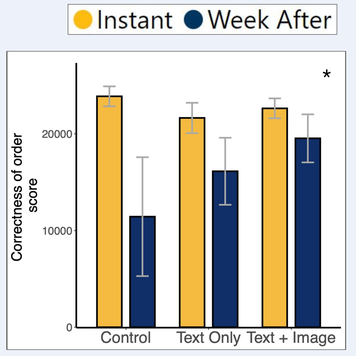


Figure 2: Instant vs Week-after scores for correctness of the order of items recalled, using a sum of distance squared formula.

- Surprisingly, Control group outperformed Group A by **26.28%**, and Group B by **21.32%** in short-term (Instant) recall
- We suspect this is due to Groups A & B having more to read through in 8 minutes
- However, Groups A and B both outperformed Control by **19.23%** in the Week After results, suggesting the LLM hints were particularly memorable and long-lasting

Experience Survey Results

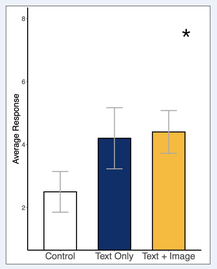


Figure 3: How hurried participants felt during memorization task.

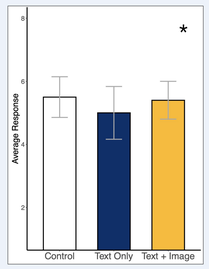


Figure 4: How mentally demanding the task felt.

> “It was really helpful to see a visual aid to help facilitate a mental association between a location and a grocery item.”

> “It [technological aid] -assisted me with the creative process in a way that made me understand what item I’m supposed to memorize, making the process a whole a lot easier to do.”

* Error bars represent standard error.

- Control group reported feeling the least rushed, likely due to lack of hints to read
- All groups reported a similar level of mental demand
- Therefore, without the time pressure (8 minutes), Experimental Groups A and B might find MoL memory tasks less demanding than Control
- Separate question indicates users favoring the use of MoL with technological aid significantly more than without, indicating GPT-4 aids in the tedious mapping process

Discussion

- Still need more participants (only 16 official data points now) to draw conclusions
- Participants have different memory ability and learning styles; we aim to account for these in future studies
- Currently, we use whatever GPT-4 outputs first; we aim to create a quality control function for the GPT-generated images to ensure good output images
- Overall, our results indicate LLMs significantly improve long-term recall and appeal of MoL

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