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Research Paper

Method of Loci, Deep Processing, and Shallow Processing: A Constructive Comparative Study of Memory Performance in Young Adults

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ABSTRACT

The method of loci is an ancient mnemonic strategy that is proven highly effective but at the same time possesses a high level of difficulty to master. In this study, an altered version of the classic method of loci (developed by the researcher) is tested by comparing it to two other mnemonic strategies – deep processing (animacy), and shallow processing (vowel counting). The purpose of this modification from the researcher is to determine whether a version of 'method of loci' is possible without excessive use of association, which is not an aspect of proficiency for all individuals. The study compared the memory performance of participants for three different mnemonic strategies – 'method of loci', 'animacy' (deep processing), and 'shallow processing' (vowel counting) with a wordlist containing 72 words (24 words per condition). The alternate hypothesis of this study is that the performance of participants with the method of loci condition would be higher than both animacy and shallow processing conditions. The results revealed that the performance of participants with the method of loci condition were higher than with the shallow processing condition but to some extent lower than the performance of participants with the animacy condition. This finding determined that further testing might be able to provide conclusive evidence regarding the efficiency of the altered method of loci strategy. The reasons for further testing are detailed in the study.

Keywords: *Method of Loci, Mnemonic strategies, Memory Performance, Deep Processing, Shallow Processing*

Mnemonic devices aid to improve memory retention of acronyms, rhymes, and such by connecting data by generating visual imageries or through creation of a story. Mnemonics are primarily effective for rote memorization (McPherson, 2010). The various aspects encompassing mnemonic devices for efficient 'encoding' of information are 'elaborative encoding', 'retrieval cues', and 'imagery' (Bransford, 1982). Most mnemonic strategies are characterised by visual imagery as the key component (Belleza, 1983). The most common techniques are the 'method of loci, the link method, and the pegword technique.' Although these techniques are effective, they possibly possess lower value as universal strategic techniques than the 'transformational elaborative' devices — 'the keyword method, and face-name association' (Intons-Peterson & Newsome, 1992).

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The function of imagery in aiding memory is generally misinterpreted (Belleza, 1983). Systems that use 'words' rather than 'images' have been revealed to be correspondingly effective (Belleza, 1983). Imagery has one key benefit – it is the comfort with which multiple pieces of information can be linked using 'imagery'. Imagery also has one key drawback - it is the struggle many individuals have with generating images (McPherson, 2010).

Frances Yates labelled the mnemonic device treasured by the ancient Greeks as the "Art of Memory" in her book 'The Art of Memory' (Yates, 1966). Now, this device is referred to as the method of loci (McPherson, 2010). The device itself is attributed to 'Simonides', a Greek poet from the 5th century B.C. Simonides is assumed the acclaim for the 'art of memory' not only because he revealed how vital 'order is for memory', but also because he placed prominence on the significance of 'visualization' (Yates, 1966).

'Elaborative Encoding' is a very important aspect of not just the method of loci but mnemonic devices in general (Foer, 2011). The overall idea is to alter any plain phrases or blocks of information, that is encoded to memory into something creative, colourful, and something out of ordinary that it would be difficult to forget (Foer, 2011). This type of encoding can be applied to any form of information and essentially forms the underlying principle for using the method of loci effectively (Foer, 2011).

The 'oral presentation effect' seems to be linked to a more effective use of images during listening, that is then reflected in memory performance. Baddeley and collegues (1990) and Logie (1995) found that a concurrent visual task disrupts the performance of subjects using the Loci method (based on visual and spatial cues) more than that of subjects using the Pegword system (based only on visual cues) (H.Logie, M.Zucco, & D.Baddeley, 1990) (Logie, 1995). Additionally, unpredicted 'visual material' interrupts the 'memory performance' of participants using an 'imagery-based' method of loci strategy and unanticipated speech disrupts subjects using 'verbal rehearsal' based method of loci strategy (Logie, 1995).

The 'oral presentation effect' has been demonstrated with subjects instructed to use Imagery, i.e., choose and visualize the cue-words of the paragraphs to be recalled (Moè & Beni, 2005). Whilst a 'written presentation effect' has been found with subjects using verbal Rehearsal, i.e., instructed to select and repeat cue-words (Moè & Beni, 2005).

More recently, McConnell and Quinn (2000) found that interference in a visual task occurs if a concurrent dynamic noise field is presented, but not in the case of a static field presentation and that, a critical variable is the manipulation of the number of changes within the noise field (Quinn, 2000) . A study by Andrade, Kemps, Werniers, May, and Szmalec (2002) showed that a dynamic visual noise field disrupts performance of subjects using the peg word mnemonics, but not the recall of static visual materials (Szmalec, Andrade, Kemps, Werneirs, & May, 2002). Interfering effects of visual activity on imagery are further confirmed by research carried out in the neuro- and psycho-physiological fields (Farah, 2000).

Use of the classic 'Loci method' includes (1) picking and learning by rote a series of separate loci (locations) of an accustomed place (aka memory palace) (house, pathway, etc.,); (2) engaging in 'elaborative encoding' for the provided information (3) introducing the encoded information (images, flying letters, etc.,) of the information in the designated

'loci' (Yates, 1966). The recall phase works when individual revisits (imagines) the selected 'loci' of the place or 'memory palace'. The information encoded within each 'loci' can be retraced when that particular 'loci' is visualised by the individual (Yates, 1966). The 'images' encoded differ in regards to the information to be memorized, while the 'memory palace or loci pathway' is usually unchanged (Yates, 1966). Certain studies show that the most effective 'Loci pathways' have a number of characteristics. They are to be circular to impede the occurrence of 'serial position effects' (Beni & Cornoldi, 1985), each locus (location with the encoding) should be well-illuminated, at a comparable distance from one another and be of comparable size. Studies show that multiple images can be placed in the same locus since there is no evidence of any proactive interference occurring between images (Moè & Beni, 2005).

The altered method of loci technique of the researcher is a process where the participant is first required to imagine a big white room (white walls, white floor, white ceiling, and white door). After this, the participant is required place the word(s) in the white room one after another, as they encounter them. During recall, the individual is required to mentally place themselves in the room and imagine retrieving each word in order to recall them. The purpose of this modification from the researcher is to determine whether a version of 'method of loci' is possible without excessive use of association, which is not an aspect of proficiency for all individuals.

The reason for the comparison of the modified 'method of loci' strategy to 'deep processing' strategy was that 'deep processing' is a well-established mnemonic strategy that has been proven, through numerous studies, to be an effective strategy (Dinsmore & Alexander, 2012) (McPherson, 2010). The reason of the comparison to the 'shallow processing' condition was to determine a base level of efficiency for the modified 'method of loci' strategy. Numerous studies have shown that 'shallow processing' is one of the weakest mnemonic strategies (Dinsmore & Alexander, 2012) (McPherson, 2010).

REVIEW OF LITERATURE

A study by Ralph Dougherty in 1977 describes a teaching strategy designed to increase student retention while maintaining high academic outputs in undergraduate organic chemistry. The objective of this experiment was to modify the knowledge gaining strategies (Dougherty, 1997). In order to achieve this, the experimenters sought the development of learning skills. They designed a stratagem to develop long-term memory for large number of facts (Dougherty, 1997). After initial assessments, the experimenters discovered that one of the prominent causes of poor performance was 'photographic' records of the lectures. Students who learned from the 'photographic' lectures performed better than other students (Dougherty, 1997). The second method that the experimenters used was creating an outline for the course and having the students follow the outline. The outline is the key element in this experiment because it lays a solid foundation for the students to follow which is an efficient learning method (Dougherty, 1997). It allows the students to build the concepts they study around the outline. This leads them to achieve a much more organised form of data in their minds and that is the single most important factor to build a memory palace (Dougherty, 1997).

The results showed that a series of interventions in undergraduate organic chemistry involving the method of loci could substantially increase retention of memory among

students without degradation of standards of performance (Dougherty, 1997). This study further emphasizes the effectiveness of the classic method of loci mnemonic.

Ayisha Qureshi conducted another study on a similar context of mnemonic strategies and education in 2014, which uses the method of loci to enable learning in endocrinology leading to improvement in student performance as measured by assessments. This study was conducted at Rawal Medical College (Islamabad, Pakistan) with a class of 78 second-year medical students. The topic covered was insulin and DM. All the students were taught insulin and DM in a moralistic fashion, involving two lectures. Each lecture covered 60 min. After the moralistic lectures had finished, 28 students were randomly chosen and then taught insulin and DM with the Method of loci technique (Ayisha Qureshi, 2014)

The other students in the class revised the same topics (insulin and DM) and finished in-class quizzes. They were permitted open textbook reference and were permitted to take the completed worksheets home. This was a self-study knowledge gaining session (Ayisha Qureshi, 2014).

The entire class underwent an equal level of assessment through a quiz, which comprised of multiple-choice questions (MCQs). The result of the quiz was used in data analysis to compare performance of the class and also as a medium of comparison between the method of loci and the self-learning method through in-class tests and worksheets (Ayisha Qureshi, 2014).

The results revealed a highly substantial increase in the number of accurate responses to the questions when tried by the students who had been taught the method of loci when matched with students who had learnt through the self-directed learning session (Ayisha Qureshi, 2014).

These two studies highlight on one of the researcher's motivations behind the current study. The researcher intended to be able to introduce a 'method of loci' version that does not include excessive association but is still able to encode a large pool of information. The motivation was to be able to able to help students with a simpler mnemonic strategy. The reason why so little individuals use memory strategies despite there being indispensable evidence of its effectiveness is that many individuals perceive it to be rather cumbersome and time consuming (McPherson, 2010).

Another study by Massen and colleagues investigated the effects of instruction on learner's ability to generate an effective pathway in the method of loci (Massen, Vaterrodt-Plünnecke, Krings, & Hilbig, 2009). Learning and remembering, especially of serially ordered information, is enabled by this technique, which includes mentally merging noticeable loci on a familiar path with the items/concepts to be learned (Massen, Vaterrodt-Plünnecke, Krings, & Hilbig, 2009). There are numerous substitutes of this method that vary in the type of path that is recommended to the user and it is indirectly assumed that these variants are equivalent in effectiveness. This study aimed to test this assumption (Massen, Vaterrodt-Plünnecke, Krings, & Hilbig, 2009).

23 female and 17 male participants from the University of Bonn were recruited for the study amassing to a total of 40 participants. The participants for the two groups: 'house-loci' and

'street-loci' were randomly selected (Massen, Vaterrodt-Plünnecke, Krings, & Hilbig, 2009).

On consecutive days two sessions were conducted with each participant. In the first session participants underwent training in the method of loci. Primarily they were randomly allocated to one of the two training conditions and then asked to mark 20 locations that are unique and stand out to them alongside a well-known path on a sheet of paper (Massen, Vaterrodt-Plünnecke, Krings, & Hilbig, 2009).

After the participants had memorized the path, they were asked to replicate it on another sheet of paper to guarantee that the accurate order had been learned comprehensively (Massen, Vaterrodt-Plünnecke, Krings, & Hilbig, 2009). Next the technique of the method of loci was taught using two rehearsal lists, containing 20 items each. Participants were taught to connect the items visually with the loci they had designated and to do so conserving the right order of items (Massen, Vaterrodt-Plünnecke, Krings, & Hilbig, 2009).
The data analysis of the study revealed a substantial main outcome of loci type, replicating a higher performance of the street-loci group as matched to the house-loci group (Massen, Vaterrodt-Plünnecke, Krings, & Hilbig, 2009). This study showed that the effectiveness of the method of loci mnemonic varies depending on the 'type of path' or 'type of palace' used for the 'elaborative encoding.'

In the current study, the researcher attempted to test the effectiveness of the method of loci mnemonic with a different 'type of path' or 'palace' than the conventional variants. Therefore, this study was conducted to empirically determine if this 'type of path' for the modified method of loci would be effective in comparison to other mnemonic strategies.

METHODOLOGY

Hypothesis

This study looked into the efficiency of three different mnemonic strategies; namely 'method of loci', 'animacy (deep processing)', and 'shallow processing'. The memory performance of participants using all three strategies was measured. The 'method of loci' strategy used in this study was a modified version of the classic method of loci as is indicated in the Introduction of this study.

H0: The efficiency of the modified 'method of loci' condition would not yield higher memory performance when compared to the 'Deep' and 'Shallow' mnemonic strategies.
H1: The efficiency of the modified 'method of loci' condition would yield higher memory performance when compared to the 'Deep' and 'Shallow' mnemonic strategies.

Participants

This study had 26 undergraduate and postgraduate students between the ages of 18-35. An experiment, which was designed on MATLAB, was conducted. All participants had normal or corrected-to-normal vision and gave an informed consent. The participants were all randomly selected. Majority of the participants were female but since this study measures memory performance, it did not have any effect on the outcome. A few trials of participants in the 'method of loci' condition lacked their complete response.

Design, Apparatus and Stimuli

The study was a within-subjects design. It refers to a design where all the participants are measured in several conditions. In this study, all 26 participants were measured in three different conditions, namely, 'method of loci', 'animacy' (Deep processing), and 'shallow processing' (vowel counting) condition. These conditions were the independent variables. The dependent variable was the 'memory performance' of the participants. The purpose of this design was to ensure the best method to compare the participant's memory performance across all three conditions to determine the most effective condition. In this study, the 'method of loci' used is different from the classic versions. The researcher made a few alterations and used this version in the study to test its effectiveness. The details regarding the modified 'method of loci' strategy is in the 'Introduction' section of this study.

The experiment itself was designed on MATLAB. The researcher's advisor designed the experiment. The experiment required a computer, designated word list, and the MATLAB software. The participants were presented with three sets of words with short intervals between each set. Each set of words corresponded to one condition. The interval in between each set of words was used to present instructions regarding the next set of words. For each participant, the order of the sets of words was randomised. At the end of all three sets of words, the participants were asked for a recall test in the form of 'word recognition'. They were randomly presented with words and were asked to select from which of the three conditions that the word originated. To ensure the standard difficulty and unbiased recall test words that did not appear in any of the sets were also used in the word recognition test.

Procedure

Participants were informed that this study tested the efficiency of three different mnemonic strategies by having them practice each strategy with a set of words. They were then instructed to sit in front of the computer where the researcher opened the experiment on MATLAB. Before the experiment commenced, the participants were told that all the instructions would appear on the screen as the progressed through each slide (manually operated with arrow keys). They were also told to use the arrow keys as their response keys and the instructions would detail further on which arrow key to use for the response. They were further instructed to keep in the mind the possibility of a recall test through the consent form. They were finally told to ask the researcher if they had any concerns during the instructions slide. After all these instructions were given, the experiment commenced.

The first few slides contained the general instructions regarding the study. Following those slides, the instructions for the first set of words were displayed. The slide described the task, which was to read each word, and if the condition was satisfied then they had to respond with either the right or left arrow key. The words were presented at a rate of 1 second per word. Preparation for each trail was also at a rate of one second for each trial. The interval between the offset of one stimuli and the onset of the next stimuli was 0.5 seconds. For instance, in the 'animacy' condition, they were asked to press the right arrow key if the word describes a living thing and to press the left arrow key if the word describes a non-living thing. Similarly, in the 'shallow processing' condition, they had to respond with the right arrow key if the word had more than two vowels and the left arrow key if the word had one vowel or no vowel. In the 'method of loci' condition, they had to use the description of method of loci mentioned earlier for each word and respond with the right arrow key for each word. This phase is referred to as the encoding phase.

In between each set of words, the instruction slide for the next set would appear. This served as an interval between tasks for the participants. For each condition, 24 words were presented making 72 words across all three conditions. After all, three sets of words were presented; a 'word recognition' test was presented to the participants. In the test, the instruction slide described participants to first identify if the displayed word was in the experiment or not. If the word was in the experiment, they had to respond by clicking on 'old' on the monitor. If the word was not in the experiment, then they had to respond by clicking 'new' on the monitor. Further, if they responded for a word with 'old' they would be taken to a separate screen where they would have to identify the condition in which they encountered the word. The conditions were displayed on the screen and they had to click the mouse to identify their response. They were asked to recall as accurately as possible and not guess their response. This phase is referred to as the retrieval phase. In addition to all 72 words being presented in the 'word recognition' test, an additional 72 words, which did not appear in the experiment, were also presented in the test. Based on their performance on this test, the efficiency of all three conditions (mnemonic strategies) were determined.

Data Preparation

The raw data collected from all 26 participants were first arranged in one EXCEL file. Following this the responses were categorised into, 'word', 'condition', 'recognition response', 'recognition reaction time', 'recognition accuracy', 'source response', 'source accuracy', 'answer (for word recognition test)', 'judgement accuracy', and 'judgement reaction time'. Further details on the relevance of each category is mentioned in the results section of this study. While processing the raw data it was noticed that, a handful of participants had not followed the instructions and did not press the right arrow key as a response for words in the 'method of loci' condition, which led to contradicting results for the 'recognition accuracy' category. This is considered as a limitation of this study. This is further emphasized in the discussion section.

RESULTS

In the study, the effectiveness of the method of loci (i.e. memory palace) condition in comparison to the animacy (i.e. deep processing) condition and the shallow processing condition (i.e. vowel counting) was measured. The hypothesis of the study was that the performance of participants in the method of loci condition would be higher than that of their performance in both the animacy conditions and the shallow processing conditions.

The dependent variables measured in the study were 'judgement accuracy', 'judgement response times (RT)', 'recognition accuracy', and 'source memory accuracy'. The effectiveness of all three conditions were measured with respect to these dependent variables. The statistical measure used for data analysis is a repeated-measures ANOVA. The effect measured is the 'levels of processing'. The efficiency of 'levels of processing' of the words in each condition would reveal the effectiveness of each condition.

'Judgement accuracy' refers to the decisions made by the participants during the encoding phase. 'Judgement response times' refers to the time it took to respond with the arrow keys in the encoding phase. 'Recognition accuracy' refers to the decisions made by the participants during the retrieval phase. 'Source memory accuracy' is the accuracy with which the participants remembered the original source of the studied word according to the conditions during the 'word recognition test.'

Below, **Table1** shows the coding used for levels of processing for the judgement accuracy of all the memory conditions.

Table 1. Coding shown for Judgement Accuracy. 1- Animacy; 2- Method of Loci; 3- Shallow Processing.

Judgement Accuracy

Within-Subjects Factors

lop	Dependent Variable
1	judgeACC_animacy
2	judgeACC_mempalace
3	judgeACC_vowels

Table 2. Repeated Measure ANOVA indicating the within-subject effect for lop – levels of processing for the variable 'Judgement Accuracy', across all three memory conditions.

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.
lop	Pillai's Trace	.524	13.229b	2.000	24.000	.000
	Wilks' Lambda	.476	13.229b	2.000	24.000	.000
	Hotelling's Trace	1.102	13.229b	2.000	24.000	.000
	Roy's Largest Root	1.102	13.229b	2.000	24.000	.000

For the 'judgement accuracy' variable, the analysis revealed a significant result of the within-subject effect, 'levels of processing', F = 13.229, p = 0.000, across all three conditions (**Table2.)**.

Table 3. Pairwise comparison of levels of processing effect on the variable judgement accuracy for all three memory conditions. 1 - animacy memory condition; 2 - method of loci; 3 - shallow processing memory condition.

Pairwise Comparisons

(I) lop	(J) lop	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
1	2	.396*	.075	.000	.202	.589
	3	-.016	.022	1.000	-.072	.040
2	1	-.396*	.075	.000	-.589	-.202
	3	-.412*	.082	.000	-.622	-.201
3	1	.016	.022	1.000	-.040	.072
	2	.412*	.082	.000	.201	.622

Table 3. indicates that the effect of levels of processing is higher on the judgment accuracy for animacy memory condition than the judgement accuracy for method of loci (MD:0.396; p:0.000). The judgment accuracy for shallow processing memory condition did not have a significant difference with the judgement accuracy for animacy memory condition (MD:-0.16; p:1.00). However, the effect of levels of processing is higher on the judgement accuracy for shallow processing memory condition than the judgement accuracy for method of Loci (MD:-0.412; p:0.000).

Table 4. Coding shown for Judgement Response Time. 1- Animacy; 2- Method of Loci; 3- Shallow Processing.

Judgement Response Time

Within-Subjects Factors

lop	Dependent Variable
1	judgeRT_animacy
2	judgeRT_mempalace
3	judgeRT_vowels

Table 5. Repeated Measure ANOVA indicating the within-subject effect for lop – levels of processing for the variable 'Judgement Response Time', across all three memory conditions.

Multivariate Tests						
Effect		**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**
lop	Pillai's Trace	.558	15.160	2.000	24.000	.000
	Wilks' Lambda	.442	15.160	2.000	24.000	.000
	Hotelling's Trace	1.263	15.160	2.000	24.000	.000
	Roy's Largest Root	1.263	15.160	2.000	24.000	.000

For the 'Judgement Response Time' variable, the analysis revealed a significant result of the within-subject effect, 'levels of processing', F = 15.160, p = 0.000, across all three conditions (**Table5.)**.

Table 6. Pairwise comparison of levels of processing effect on the variable judgement response time for all three memory conditions. 1 - animacy memory condition; 2 - method of loci; 3 - shallow processing memory condition.

Pairwise Comparisons						
(I) lop	**(J) lop**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval for Difference**	
					Lower Bound	**Upper Bound**
1	2	-1.332*	.237	.000	-1.941	-.723
	3	.028	.071	1.000	-.154	.210
2	1	1.332*	.237	.000	.723	1.941
	3	1.360*	.249	.000	.722	1.998
3	1	-.028	.071	1.000	-.210	.154
	2	-1.360*	.249	.000	-1.998	-.722

Table 6. indicates that the effect of levels of processing is higher on the judgment response time for method of loci memory condition than the judgement response time animacy memory condition (MD: -1.332; p:0.000). The judgment response time for shallow processing memory condition did not have a significant difference with the judgement response time for animacy memory condition (MD: 0.28; p:1.00). The effect of levels of processing is higher on the judgement response time for method of loci memory condition than the judgement response time for shallow processing. (MD: 1.360; p:0.000).

Table 7. Coding shown for Recognition Accuracy. 1- Animacy; 2- Method of Loci; 3- Shallow

Recognition Accuracy

Within-Subjects Factors

lop	Dependent Variable
1	recogACC_animacy
2	recogACC_mempalace
3	recogACC_vowels

Table 8. Repeated Measure ANOVA indicating the within-subject effect for lop – levels of processing for the variable 'Recognition Accuracy', across all three memory conditions.

Multivariate Tests						
Effect		**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**
lop	Pillai's Trace	.600	18.001b	2.000	24.000	.000
	Wilks' Lambda	.400	18.001b	2.000	24.000	.000
	Hotelling's Trace	1.500	18.001b	2.000	24.000	.000
	Roy's Largest Root	1.500	18.001b	2.000	24.000	.000

For the 'Recognition Accuracy' variable, the analysis revealed a significant result of the within-subject effect, 'levels of processing', F = 18.001, p = 0.000, across all three conditions (**Table8.)**.

Table 9. Pairwise comparison of levels of processing effect on the variable Recognition Accuracy for all three memory conditions. 1 - animacy memory condition; 2 - method of loci; 3 - shallow processing memory condition.

Pairwise Comparisons						
(I) lop	**(J) lop**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval for Difference**	
					Lower Bound	**Upper Bound**
1	2	.034	.045	1.000	-.082	.149
	3	.247*	.047	.000	.127	.366
2	1	-.034	.045	1.000	-.149	.082
	3	.213*	.041	.000	.108	.318
3	1	-.247*	.047	.000	-.366	-.127
	2	-.213*	.041	.000	-.318	-.108

Table 9. indicates that the effect of levels of processing is higher on the recognition accuracy for animacy condition than the recognition accuracy for the method of loci memory condition, but the difference is not significant (MD: 0.034; p:1.000). The recognition accuracy for shallow processing memory condition lower than the recognition accuracy for animacy memory condition (MD: 0.247; p:0.000). The effect of levels of processing is higher on the recognition accuracy for method of loci memory condition than the recognition accuracy for shallow processing. (MD: 0.213; p:0.000).

Table 10. Coding shown for Source Accuracy. 1- Animacy; 2- Method of Loci; 3- Shallow

Source Accuracy

Within-Subjects Factors

lop	Dependent Variable
1	sourceACC_animacy
2	sourceACC_mempalace
3	sourceACC_vowels

Table 11. Repeated Measure ANOVA indicating the within-subject effect for lop – levels of processing for the variable 'Source Accuracy', across all three memory conditions.

Multivariate Tests						
Effect		**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**
lop	Pillai's Trace	.126	1.732b	2.000	24.000	.198
	Wilks' Lambda	.874	1.732b	2.000	24.000	.198
	Hotelling's Trace	.144	1.732b	2.000	24.000	.198
	Roy's Largest Root	.144	1.732b	2.000	24.000	.198

For the 'Source Accuracy' variable, the analysis revealed a non-significant result of the within-subject effect, 'levels of processing', $F = 1.723$, $p = 0.198$, across all three conditions (**Table11.)**. This indicates that for 'Source Variable', the 'Levels of Processing' for none of the memory conditions was more effective than the other.

DISCUSSION

Prior work has shown that the method of loci is a very efficient strategy and perhaps even one of the most efficient strategies but since this study is testing an altered version of the method of loci, a comparative analysis of the data in the study with that of the previous studies would not lead to much useful conclusions.

The alternate hypothesis of this study was that the efficiency of the modified 'method of loci' condition would yield higher memory performance when compared to the 'animacy (deep processing)', and 'shallow processing' mnemonic strategies. The variables used to analyse the data were 'judgement accuracy', 'judgement response times (RT)', 'recognition accuracy', and 'source memory accuracy'. Each of these variables measure either the recognition (recognition accuracy; source memory accuracy) aspect during each condition or the judgement (judgement accuracy; judgement response times) (answers to 'word recognition' test) aspect.

An analysis of the judgment aspect revealed that for the accuracy facet, animacy memory condition was significantly more effective than the method of loci condition. For the response time aspect, method of loci condition was significantly more effective than the animacy condition. An analysis of the recognition aspect revealed that for the accuracy facet for the animacy condition was significantly more effective than the method of loci condition. For the source facet, none of the memory condition were more effective than the other.

This allows for the interpretation that the animacy condition was the most effective followed by the method of loci and then finally shallow processing. Out of the four dependent variables, the animacy condition is the most effective for two of those, whereas the method

of loci is most effective for one of those, and for one of the variables, none of the conditions were more effective than the other.

This indicates and concludes that the null hypothesis is to be accepted. This indicates that the alternate hypothesis of 'the efficiency of the modified 'method of loci' condition would yield higher memory performance when compared to the 'animacy (deep processing)', and 'shallow processing' mnemonic strategies,' is not true and can not be accepted.

The results indicated the performance for the 'method of loci' condition was only more effective than the 'shallow processing' condition and less effective than the 'animacy' condition.

Further research would be required to determine if the small sample size played a significant role in the results of this study. Furthermore, improvements to the design of the study to incorporate a measurement of the encoding process would deepen the understanding of the effectiveness of each memory condition as only retrieval was studied in this study.

REFERENCES

Ayisha Qureshi, F. R. (2014). The method of loci as a mnemonic device to facilitate learning in endocrinology leads to improvement in student performance as measured by assessments. *Advances in Physiology Education*, 140-144.

Belleza, F. (1983). Mnemonic-device instruction with adults. *Cognitive strategy research: Psychological foundations.*

Beni, R. D., & Cornoldi, &. C. (1985). Effects of the mnemonic technique of loci in the memorization of concrete words. *Acta Psychologica*, 11-24.

Bransford, J. S. (1982). Differences in approaches to learning: an overview. *Journal of Experimental Psychology*, 390-398.

Dinsmore, D., & Alexander, P. (2012). A Critical Discussion of Deep and Surface Processing: What It Means, How It Is Measured,the Role of Context, and Model Specification. *Educational Psychology Review*, 499-567.

Dougherty, R. C. (1997). Grrade/Study-Performance Contracts, Enhanced Communication, Cooperative learning, and Student Performance in Undergraduate Organic Chemistry. *Journal of Chemical Education*, 722-726.

Farah, M. (2000). *The neural bases of mental imagery.* Cambridge: The Cognitive Neurosciences.

Foer, J. (2011). *Moonalking with Einstien.* New York: The Penguin Press.

H.Logie, R., M.Zucco, G., & D.Baddeley, A. (1990). Interference with visual short-term memory. *Acta Psychologica*, 55-74.

Intons-Peterson, M., & Newsome, G. I. (1992). External memory aids: effects and effectiveness. *Memory Improvement: Implications for Memory Theory*.

Logie, R. H. (1995). *Visuo-Spatial Working Memory.* East Sussex: Lawrence Brlbaum Associates Ltd., Publishers.

Massen, Vaterrodt-Plünnecke, Krings, & Hilbig. (2009). Effects of instruction on learners' ability to generate an effective pathway in the method of loci. *Memory*, 724-731.

McPherson, D. F. (2010). What mnemonics are, and what they are for. In D. F. McPherson, *Mnemonics at a glance* (p. 34).

Moè, A., & Beni, R. D. (2005). Stressing the efficacy of the Loci method: Oral presentation and the subject-generation of the Loci pathway with expository passages. *Applied Cognitive Psychology*, 95-106.

Quinn, J. M. (2000). Interference in Visual Working Memory. *The quaterly journal of experimental psychology*, 53-67.

Rassin, Merckelbach, & Spaan, &. (2001). When dreams become a royal road to confusion: Realistic dreams, dissociation, and fantasy proneness. . *Journal of nervous and mental disease*, 478-481. Retrieved from M libraries: http://open.lib.umn.edu/intropsyc/chapter/8-3-accuracy-and-inaccuracy-in-memory-and-cognition/

Szmalec, A., Andrade, J., Kemps, E., Werneirs, Y., & May, &. J. (2002). Insensitivity of visual short-term memory to irrelevant visual information. *The quaterly journal of experimental psychology*, 753-774.

Yates, F. A. (1966). *The Art of Memory.* Routledge & Keagen Paul.

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Conflict of Interest

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