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Prospective Memory Is (Also) Not Immune to Imagery

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Abstract: The study adopted a study-test paradigm to investigate whether imagery has a similar effect on prospective memory as it does on retrospective memory. The sample consists of 160 introductory psychology students. The participants were randomly assigned into 2 between groups of imagery: no-imagery and imagery groups. All the participants first studied paired-associate words (List A-B) and were later tested on the paired-associate recall test and sentence construction task. The 2 tests were performed simultaneously. Results of data analyses using the multivariate statistical model showed that memory was better for participants in the imagery group than for participants in the no-imagery group for retrospective memory ($p < .001$), as well as for prospective memory ($p < .001$). The obtained effect sizes (ES) of 0.26 and 0.21 for retrospective and prospective memory respectively demonstrate that imagery affects not only retrospective memory, but also prospective memory.

Keywords: Imagery, Paired-Associate Words, Prospective Memory, Retrospective Memory, Sentence Construction Task

1. Introduction

One basic distinction that guides much research in human memory today is between prospective and retrospective memory. Memory researchers [5] have found it useful to distinguish between the two kinds of human memory to describe people's ability to remember past events and future intentions. Prospective memory refers to remembering to perform an intended action in the future. Prospective memory is crucial for normal functioning [8]); numerous aspects of daily functioning require prospective memory ranging from ordinary activities such as remembering to show up for appointment or to give someone a message, to more important task such as remembering what time to take medication. The processes underlining prospective remembering has not been very well understood. But unlike prospective memory, which is still at its early stages of research [6], retrospective memory has been heavily studied by memory researchers. Until recently, most research in human memory [20] [15] is concerned with memories of what people have done in the past. Retrospective memory refers to memory of people, words, and events encountered or experienced in the past or a kind of memory about things that had happened. It includes all other types of memory, including episodic, semantic and procedural [1]. The efficiency of human retrospective memory is astounding. Students with poor retrospective memory abilities often have difficulties learning and retrieving information in educational context leading to poor examination scores [16].

The present research employs experimental manipulation of imagery to examine whether imagery would affect prospective memory in similar way as it affects the more extensively studied retrospective memory. Imagery is an important component of many mnemonic-encoding strategies. By itself, imagery has considerable value in enhancing memory, and in conjunction with other mnemonic techniques, it can be a powerful tool for improving retrospective memory performance. The Japanese memorist's extraordinary memory performance in reciting the first 40000 digits of pi, for example, was related to an effective use of a combination of digit-syllable transformation and imagery mnemonics developed over extensive practice [19]. Again, the power of imagery on retrospective remembering was aptly described in the statement, "when subjects are instructed to use imagery, the difference is pronounced; even subjects' memory for meaningless nonsense syllable is

enhanced when they use imagery in learning" [2] p. 81. Virtually all studies on the influence of imagery on retrospective memory and/or learning [9, 10] [19] demonstrate that materials high in imagery are more memorable, and that learners instructed to create images often have their learning enhanced. Considerable debate surrounds the process through which this improvement is achieved. Paivio [17] argue that information is represented in two fundamentally distinct systems, one suited for verbal information and the other for images. Thus, to the extent that information can be coded within one or both of the systems, memory will be enhanced; the verbal and non-verbal codes are functionally independent and "contribute additively to memory performance" [17] p. 226. On the other hand, Pylyshyn [18], argue rather that what is special about imaged-based thinking is that it is typically concerned with certain sort of content, such as optical, geometrical, or what is called the appearance properties of things.

Despite the debate, there seems to be little doubt that imagery is important to retrospective remembering. The literature is replete with studies which demonstrate that instructing participants to form images often lead to beneficial effect on retrospective memory/remembering. In contrast, there has been characteristic lack of agreement among researchers as to whether imagery facilitates prospective memory or not. Some studies [6] [14] have found that imagery is beneficial to prospective memory performance, but other studies [3] [13] have maintained that imagery is not a very vital component of prospective memory. The problem examined in this research is to determine whether experimental manipulation of imagery would yield similar or different results on the two kinds of memory. Most evidence from imagery research comes largely from studying retrospective memory. Because imagery tends to preserve information so that it helps recall or memory, the researchers hypothesize that imagery will benefit prospective memory as much as it does the retrospective memory.

2. Method

2.1. Participants

The sample for this study comprised 160 introductory psychology students of University of Nigeria, Nsukka. A university sample was preferred not just for convenience, but because it offers a good opportunity to recruit participants of varying gender. There were 50% each of male and female students; their ages ranged from 16 – 27 years (mean age = 21.16 years; SD = 2.74).

2.2. Materials

The present study adopted a study-test paradigm. The study material was the paired-associate words (List A-B), while the test materials were the paired-associate recall test and the sentence construction task. Both the study and the test materials were presented on HP laptop computers and projected on two white boards using DLP Projectors (Configuration: RD-JT 90). The paired-associate words (i.e., List A-B) consist of 25 paired-associate words. The paired-associate words were characterized by a subtle interactive relationship between the stimulus words (i.e., the "A" in List A-B) and the response words (the "B" in the list). Thus, stimulus words (A) and the response words (B) were somewhat related. Some examples of the paired-associate words in List A-B includes: *"Thief – Incarceration"*, *"Police – Baton", "Postmaster – Letter"*, etc. Four judges asked to examine and rate if the stimulus and the response words were related somewhat showed a congruence rate of 87.07%.

The paired-associate recall test was used to measure retrospective memory. It is a 17-item test in which the stimulus words were intact without their accompanying response pairs. Thus, the test requires participants to recall and fill in the blank spaces with the correct response items/words. Some examples of the paired-associate recall test are: "Fridge - ?", "Police - ?", "Postmaster - ?" etc. A pilot study conducted by the researchers with 68 undergraduate students yielded a Cronbach's alpha of 0.83. Typical laboratory paradigm for measuring prospective memory involves asking participants to perform a task while an activity is ongoing [5] [21]. Thus, the sentence construction task, which was used to measure prospective memory, was to be completed simultaneously as when the participants respond to the paired-associate recall test. The sentence construction task simply want participants to make a sentence whenever certain stimulus words such as, 'police', 'Sokoto', 'thief', etc are presented on the white boards. The participants were told that the sentences need not be grammatically correct. There were 12 stimulus words; each attempted sentence was scored one mark while failure to make attempt at all was scored zero, resulting in minimum and maximum possible total scores of 0 and 12.

2.3. Procedure

The procedure for this study followed a largely intentional learning approach in which participants were aware that their memories would be tested. Prior to all the participants studying List A-B, participants were randomly assigned into two independent groups of imagery (imagery and no-imagery groups) with the aid of a table of random numbers. The assignment was such that there were equal numbers of males and females in the two independent (or between-subjects) groups. Imagery was varied by verbal instruction. Participants in the imagery group condition received the following instructions:

> "You will be shown some paired-associate words. You are to form an interactive imagination between each stimulus words and its response counterpart. For example, paired-associate words, such as "Boy – Bicycle" or "Monkey – Banana", you could imagine a boy riding a bicycle or a monkey eating a banana."

Participants in the no-imagery group were not given this

instruction. They were only informed that paired-associate words would be shown to them on the white boards. Following this experimental manipulation of imagery, all the participants were allowed to study List A-B (i.e., the paired-associate words list). Words toggled out in pairsand decays before another pair is shown on the white board. The duration of each paired word was 5 seconds. Thereafter, participants in the two imagery groups (i.e., imagery versus no-imagery) were tested on the paired-associate recall test and on the sentence construction task. Each imagery group was tested in a separate and quiet classroom. The procedure for test administration was the same for the two groups; the paired-associate recall test and the sentence construction task were performed simultaneously.

2.4. Ethical Consideration

The ethical consideration for this study was granted by the Ethical Board of the Faculty of the Social Sciences, University of Nigeria, Nsukka.

2.5. Data Analysis

The study used a between-groups design with a single factor and two dependent measures. The data generated by participants in the imagery and no-imagery between-subjects (or independent) groups on the prospective and retrospective memory were analyzed with an omnibus test – multivariate analysis of variance (MANOVA). The analyses were run using the SPSSFW version 20.

3. Results and Discussion

Data were analyzed based on the number of response words that participants correctly recalled from List A-B and the number of sentences they constructed with some predetermined words. The higher the score on the dependent measures, the better the memory. Given that the present study was concerned with 2 dependent measures, along with the fact the assumption of the multivariate normality was not violated (Box's M test = $p > 0.05$), MANOVA was used to test the influence of imagery on retrospective and prospective memory. The descriptive statistics of the analysis show that participants' in the imagery condition reported higher retrospective memory (7.51) than participants in the no-imagery condition (5.10). Also, participants in the imagery condition reported higher prospective memory (6.26) than participants in the no-imagery condition (4.81). There were equal numbers of males and females in the 2 independent groups. Table 1 show a matrix of mean distribution according to gender.

Table 1. *Mean difference scores of male and female participants for the 2 independent-groups of imagery (i.e., No-imagery Vs. Imagery groups).*

	Retrospective memory			**Prospective memory**		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
No-imagery	5.28 (3.04)	4.93 (2.89)	5.10 (2.41)	4.90 (2.10)	4.73 (2.33)	4.81 (2.21)
Imagery	6.78 (3.34)	8.25 (3.52)	7.51 (3.04)	6.13 (2.04)	6.40 (1.77)	6.26 (1.90)
Mean diff.	1.5	3.32	2.41**	1.23	1.67	1.45**
N	80	80	160	80	80	160

Note: the values inside the parentheses represent standard deviation.
** = significant, p<0.001.

First, MANOVA test statistic showed that imagery was statistically significant on the linear combination of the 2 dependent measures (i.e., retrospective and prospective memory), $F(2, 151) = 18.05$, $p < 0.05$ (Pillai's trace =0.19; Wilk's Lambda =0.81). The test of significance for the overall means indicate that the difference in mean scores between participants in the imagery group and participants in the no-imagery group were statistically significant for retrospective memory, $F(1, 156) = 22.63$, $MSE = 232.81$, $p < 0.001$, $ES = 0.26$, as well as for prospective memory $F(1, 156) = 19.65$, $MSE = 84.10$, $p < 0.001$, $ES = 0.21$. The effect size (ES) values of 0.26 and 0.21 for retrospective and prospective memory respectively, belonged to the effect size category. Cohen [4] classified in the range of medium effect for a single-factor experiment. The effects are therefore not trivial [7], more than 80% of the variances in the two kinds of memory were explained by imagery.

This study examined whether experimental manipulation of imagery would yield beneficial effect on prospective memory as it normally does on retrospective memory performance. First, imagery produced beneficial effects on retrospective memory, as well as on prospective memory. With regard to retrospective memory, this finding is not unexpected; the result converged with previous studies on retrospective remembering [10], [16], [19]. In contrast, the finding that participants in the imagery group performed better than others in the no-imagery group on prospective remembering is potentially very interesting. The effect of imagery on prospective memory has been fraught with controversy. Two major arguments of this are that (1) imagery benefits prospective remembering and (2) imagery does not facilitate prospective remembering. The result of the data analysis supports the hypothesis examined in this study (i.e., the first explanation), that imagery will benefit prospective memory performance. This supports the positions adopted by [6] and [14] that imagery is beneficial to prospective memory performance.

4. Conclusion

Unlike retrospective memory which has been more extensively studied, the process underlining prospective

memory has not, as yet, been very well understood. The problem examined in this research was to investigate whether experimental manipulation of imagery would affect prospective memory as much as it affects retrospective memory. Analysis of data using the multivariate statistical tool show that imagery produced beneficial effects on retrospective memory, as well as on prospective memory. In conclusion, the present study demonstrates that imagery is a powerful strategy for increasing memorability of information, not only in retrospective memory, but in prospective memory as well. This study is limited by its inability to investigate whether Paivio [16] or Pylyshyn [18] positions on imagery process is true or false in an absolute sense. Therefore, the authors call on future researchers to pit the two frameworks against each other to determine which is more likely to substantially support data on the effect of imagery on both retrospective and prospective memory.

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