

**A COMPARISON OF SUBJECTS' OWN IMAGERY
VERSUS EXPERIMENTER-SUPPLIED IMAGERY
AS A MNEMONIC DEVICE IN PAIRED-ASSOCIATE LEARNING**

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ABSTRACT

The purpose of this study was to determine whether subjects' own images or images supplied by the experimenter provide greater facilitation in paired-associate learning. The own-imagery group was shown pairs of words and told to learn them by forming images for these words and visualizing these images together. The supplied-imagery group was shown the same words as the own-imagery group and was also shown pictures of these words. They were told to learn the words by seeing images of the pictures they were provided with and visualizing these images together. In addition, 2 no imagery control groups were added and study time was varied.

The results indicated that the imagery instructions were beneficial compared to the standard PA learning instructions. This beneficial effect of imagery increased with trials and in addition learning was facilitated with the longer study time. Although none of the interaction effects of time were significant, a significant interaction was obtained with sex and type of pair. Post hoc analyses of this interaction indicated that males shown word pairs performed more poorly than males shown word-picture pairs and females shown word pairs or word-picture pairs. This was interpreted as indicating that supplied imagery is beneficial for males but not for females.

TABLE OF CONTENTS

CHAPTER		PAGE
1	INTRODUCTION.....	1
	Historical Background.....	1
	General Review.....	4
	Verbal versus Imaginal Coding.....	5
	Mnemonic Devices.....	9
	Verbal Mnemonics.....	10
	Imaginal Mnemonics.....	12
	Theories of Imagery Mnemonics.....	19
	Purpose of the Research.....	30
	Type of Stimulus Materials Used.....	35
	Time.....	39
2	METHOD.....	41
	Design.....	41
	Subjects.....	41
	Materials.....	43
	Procedure.....	43
3	RESULTS.....	45
	Post Hoc Questionnaire Data.....	50
4	DISCUSSION.....	56
5	SUMMARY AND CONCLUSIONS.....	60
	Practical Applications and Directions for Future Research.....	60
	REFERENCES.....	62
	APPENDIX A. Word Pairs.....	76
	APPENDIX B. Instructions.....	79
	APPENDIX C. Questionnaire.....	82
	APPENDIX D. Raw Data.....	89
	APPENDIX E. Post Hoc Tests.....	95

LIST OF TABLES

TABLE		PAGE
1	Experimental Design.....	42
2	Mean Number of Correct Responses for each Group as a function of Trials and Sex of Subject.....	46
3	Analysis of Variance of Mean Number of Pairs Correct for Groups WP-3, W-3, I-WP-3, and I-W-3.....	47
4	Analysis of Variance of Mean Number of Pairs Correct for Groups I-WP-3, I-W-3, I-WP-7, and I-W-7.....	51
5	Number and Percentage of Total Items in each Learning Strategy Reported by Each Group.....	53
6	Proportion and Percentage of Pairs Correct on Trial 2 with each Reported Strategy.....	54

LIST OF FIGURES

FIGURE		PAGE
1	Mean Number of Items Correct for Groups WP-3, W-3, I-WP-3, and I-W-3 as a function of Instructions and Trials.....	48
2	Mean Number of Items Correct for Groups WP-3, W-3, I-WP-3, and I-W-3 as a function of Pair Type and Sex.....	49
3	Mean Number of Items Correct for Groups I-WP-3, I-W-3, I-WP-7, and I-W-7 as a function of Pair Type and Sex.....	52

INTRODUCTION

Historical Background

The area of study encompassed by the present experiment is that of imagery mnemonics. Basically, "mnemonic" refers to any device which is a possible aid to memory. This includes facilitation which may be produced by encoding. The word "encoding" as used here refers to the verbal and/or visual (imaginal) organization or transformation of material to be learned. An example of a verbal type of encoding on a paired-associate (PA) learning task is the formation of a sentence or phrase containing the stimulus and response members of the pair. Imaginal encoding consists of forming images of the objects represented by the stimulus and response and visualizing these images in some form of interaction. Since the present study focuses on imaginal mnemonics, the following discussion is centered around these. Limited coverage is given to verbal mnemonics except as they relate to imagery.

Perhaps the earliest recorded expression of interest in the scientific study of imagery was that of Sir Francis Galton. Using a questionnaire method he attempted to measure individual differences in the vividness of imagery (see Galton, 1880). Besides Galton, the structuralists such as Wundt (1918) and Titchener (1919) viewed imagery as a phenomenon worthy of investigation. They were mainly interested in the content of imagery and they used introspection as the method of study.

In the early part of the century a variety of experimental approaches were used to study imagery. Some of these were attempts to form a classification system which would categorize people on the basis of the type

of imagery they used (Betts, 1909; Fernald, 1912). It was the view of these investigators that imagery types based on the various sensory modalities could perhaps be identified (e.g., olfactory, visual, auditory, etc.). Although little evidence for this was found, these studies played an important part in the early experimental literature on imagery. Other studies investigated the relationship between imagery and intelligence (e.g., Carey, 1915). During this period there was even some recognition of the practical applications of imagery. For example, Hill (1918) found imagery helpful in learning a list of words.

The popularity that the study of imagery enjoyed was short-lived. With the rise of behaviourism in the second decade of the twentieth century, the study of imagery fell into ill-repute. Behaviourism was largely due to John B. Watson (1913, 1930) who insisted that experiments in psychology should be restricted to the study of behaviour. Paivio (1969) in discussing Watson, says that "partly on philosophical grounds and partly on the basis of the experimental evidence then available, he concluded that mental images are mere ghosts, without any functional significance whatever (p. 242)." Thus, with the rise of behaviourism there was a corresponding decline in the study of imagery. Some exceptions to this decline of interest in imagery were evident, most notably work on eidetic images and after-images. (For eidetic images see Allport, 1924, 1928; Jaensch, 1930; Teasdale, 1934; for after-images see Allport, 1928; Berry, 1922, 1927; Craik, 1940; Feinbloom, 1938.)

Undaunted by the rise of behaviourism, a few researchers continued to study imagery other than eidetic or after-images. Griffitts (1927) used the introspective method to measure imagery vividness. Davis (1932)

tried to relate subjects' subjective reports to their objective test scores. Bartlett (1932) and Pear (1937) were interested in classifying imaging abilities into those mainly verbal and those mainly visual. However, it was not until the mid 1950's that imagery had again become an important area of study in psychology. In part this interest can be attributed to certain entertainers who advocated the practical uses of imagery for memory (e.g., Furst, 1957; Lorayne, 1957). There were other reasons too. Holt (1964) in his article "Imagery: The Return of the Ostracized," suggests that many practical problems have reawakened experimental interest in imagery. In discussing some of the accidents which imagery may cause (e.g., when radar operators are monitoring a scope for long periods) he writes as follows:

In such a situation, when serious accidents can occur on its account, practical people are not likely to be impressed by the argument that imagery is unworthy of study because it is mentalistic and virtually impossible to experiment on with animals.

(Holt, 1964, p. 257)

Holt mentions that the correlations found between brain waves and imagery (Short, 1953) have also played a role in the reemergence of imagery. He further suggests that the work of such developmental psychologists as Piaget (1952) has been important in this respect. Bruner (1964) too, has been a major influence here. Bruner refers to imagery as "iconic representation" which is one of the three modes of representation in his system.

Today imagery is widely studied in many different experiments. It is a frequent topic of investigation in recent verbal learning literature where its use as a mnemonic device has received particular attention (e.g., Bugelski, Kidd, and Segmen, 1968; Delin, 1968; Keppel and Zavortink,

1969; Paivio, 1968a; Rimm, Alexander, and Eiles, 1969; Schnorr and Atkinson, 1969; Taylor and Black, 1969).

The following sections serve as a general literature review of mnemonics with particular emphasis on imaginal mediation. Some attention is given to the various theories relating imaginal encoding to learning and memory.

General Review

At one time the memory aids that some subjects spontaneously used in learning experiments were considered a nuisance (e.g., see Woodworth and Schlosberg, 1965, p. 708). Now these devices are the specific objects of study in several different kinds of experiments. Subjects may be instructed to use mnemonics (Rimm, Alexander, and Eiles, 1969) or they may simply be instructed to learn the material and then be given a post experimental questionnaire to determine the various mnemonics used (Martin, Boersma, and Cox, 1965). Still another method is to manipulate the type of pairs used - for example, comparing word pairs rated high in imagery with pairs which are rated low in imagery (Paivio and Yuille, 1967) or varying the meaningfulness of nonsense syllables (e.g., Underwood and Schulz, 1960).

Not only have various methods been developed for studying memory aids, but various types of mnemonic devices have also been identified. To identify every single type of memory aid would be difficult since some people use devices which are highly idiosyncratic. However, general classification systems have been devised. Besides the frequently used distinction made between mnemonics which are imaginal and those which are verbal, the latter is often further subdivided. For example, Martin, Boersma, and Cox (1965)

use a detailed system which classifies verbal strategies in order of complexity.

Thus, the study of mnemonic devices has become an important area of investigation in psychology. This is as it should be because psychologists are finally systematically studying what people have been doing on their own for years--namely using various devices to aid the learning and retention of material. This has enormous practical significance since memory plays such an important part in today's highly technological society.

Verbal Versus Imaginal Coding

There are several recurring issues which arise in the study of mnemonic devices. One important question is whether there are in fact two different coding systems (i.e., imaginal and verbal). Although verbal encoding versus imaginal encoding is a conceptualization frequently used, the possibility exists that there is no difference between them (i.e., both represent the same coding process). The literature relevant to this question presents some evidence that verbal representation and imaginal representation are separate coding processes. Brooks (1968) presents performance data to support his view that each of these is processed in a modality-specific way. He compared the recall of spatial information with that of verbal information when the recall task was either vocal activity or spatially monitored activity. Using as one of his basic assumptions the idea of interference when two tasks are attempted at the same time within the same system, Brooks found that vocal activity most disrupted recall of the verbal information while spatially monitored activity most disrupted recall of spatial information. Although the type of coding used in Brook's study is the simple reception of stimuli, it is possible

that his data are also applicable to coding processes in which subjects make an effort to transform or organize material in an imaginal or verbal manner. Kaplan, Kaplan, and Sampson (1968) present GSR data which are in agreement with the conclusion of differential encoding for different types of stimuli. They argue strongly for both imaginal and verbal modes of memory storage which can be independent or can interact in some cases. Bahrick and Boucher (1968) attempted to assess the likelihood of independent storage systems by correlating the retention of visual coding with the retention of verbal coding for the same stimuli. Although they found no correlation between subjects' recall of object names and the accuracy of visual recognition of the objects, the authors nevertheless reject the idea of independent storage systems. They suggest that some of their data as well as some of the subjects' reports indicated that verbal recall did depend on the retrieval of visual storage and that the particular tests used in the experiment may not have been adequate to show this. Although this is possible, it is little help in arriving at a conclusion on this question of whether the two are different coding systems.

A somewhat related question asks which type of mnemonic device is more efficacious for learning (provided of course that one accepts that these two types of mnemonic devices exist). If the studies relevant to this question provide performance data which are different for verbal and imaginal mnemonics then this would seem to suggest that there are two storage systems as well as showing which type of mnemonic device is superior.

Several studies comparing verbal and imaginal mediators have found imagery to be superior. Raser and Bartz (1968) compared imagery and word instructions on a PA learning task in which the pairs were nouns and/or

their line drawings. The imagery instructions resulted in higher recognition performance while the word instructions resulted in lower recognition performance than a control group given standard instructions. Hulicka and Grossman (1967) used a PA word task and compared the efficacy of instructions to mediate in different age groups. For both young and old subjects imagery was superior to verbal mediation. Further support on the usefulness of imaginal mediation instructions compared to verbal mediation instructions is provided by Rimm, Alexander, and Eiles (1969). There is also data available from subjects' post hoc reports. Paivio, Yuille, and Smythe (1966) found that learning scores were highest for pairs on which subjects reported using imagery.

Other studies report the superiority of verbal mediation. Using picture pairs and children as subjects, Davidson and Adams (1970) found that joining the pairs by a preposition (language connective) was more effective than showing the pictures in interaction (imaginal mediation). Milgram (1967) also used children as subjects on a PA picture list. His results suggested that the verbal context (providing a sentence combining the stimulus and response) was more effective than the visual compound (showing the pair in interaction).

Still other research suggests no differences when comparing imaginal and verbal mnemonics. Wood (1967) used a serial list and found no difference in recall between subjects instructed to use verbal mediators and subjects instructed to use bizarre imagery. Reese (1965, 1969a) and Davidson (1964) presented children with a PA task and found that verbal compounds and pictorial compounds were equally effective. Yuille and Paivio (1968) also found no difference in recall between subjects in-

structed to use imaginal mediators and subjects instructed to use verbal mediators.

While all the evidence is not positive, it seems reasonable to conclude that imaginal and verbal mnemonics may function as alternate coding systems. Although some of the studies reported found no differences between them, these studies are in the minority. Furthermore, it seems reasonable to conclude that even though the two are alternate methods of encoding, they are often used together. As for which type of mnemonic device is better, this question may not be a completely meaningful one - at least the way it is currently stated. The discrepant results reported (with some studies finding imagery mnemonics superior and others finding verbal mnemonics superior) suggest a different interpretation of the problem. Rather than asking which type of mnemonic is a better one, it makes more sense to ask which is a better mediator for what types of material and under what conditions. Two variables of importance appear to be type of material and presentation rate. Yarney and Csapo (1968) report that verbal mediation and imaginal mediation were equally efficient for concrete words but verbal mnemonics were superior for abstract words. With regard to presentation rate, imaginal mediators may suffer at fast presentation rates when compared with verbal mediators since image arousal is slower than verbal association to both concrete and abstract words (Paivio, 1966).

The studies comparing verbal and imaginal encoding have been discussed not only because they are important in the literature on mnemonics but also because their results are open to another interpretation which is relevant to the own versus supplied dimension studied in the present

experiment. This will be discussed in the purpose section.

Mnemonic Devices

There is little disagreement in the literature on the usefulness of mnemonic devices in general. A large number of studies support the efficacy of mnemonics when compared with no mnemonics. Clark, Lansford, and Dallenbach (1960) found that many subjects spontaneously formed mediators, some of which were simple and others highly elaborate. With trials to criterion as a measure, eight pairs without mnemonics required twice as long to learn as 12 pairs with mnemonics. Bugelski (1962) reported that pairs for which mediators could be formed were most easily learned. Hulicka and Grossman (1967), Paivio and Yuille (1967, 1969), Yarmey and Csapo (1968), and Yuille and Paivio (1968) found that instructions to mediate facilitated recall when compared with control groups which were given either repetition instructions or no set instructions in PA learning. With serial learning, Persensky and Senter (1969), Senter and Hauser (1968), and Wood (1967), have demonstrated the superiority of groups using mnemonics. Senter (1965) has made an extremely interesting review of various types of memory aids. While his conclusions should be interpreted cautiously because they are mainly the result of self-experimentation, he states that he is able to remember a large number of things by using mnemonics - much more than would be expected without them. Other studies have supplied subjects with mediators and demonstrated the superiority of these to a control condition (see Davidson, 1964; Davidson and Adams, 1970; Milgram, 1967; Reese, 1965). Thus the literature is in general agreement as to the efficacy of mnemonics although there are negative reports. (These will be discussed in the next two sections.) Persensky and Senter (1970a) explain the failure of some mnemonics research