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PREVIEW

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**Bilingual memory revisited: The effects of dual coding on
incidental learning**

Roark, Avin, Psy.D.

Pace University, 1989

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PREVIEW

**BILINGUAL MEMORY REVISITED: THE EFFECTS
OF DUAL CODING ON INCIDENTAL LEARNING**

by

Avin Roark

**A Doctoral Project Submitted in Partial Fulfillment of
the Requirements for the Degree of Doctor of Psychology
in the Department of Psychology at Pace University.**

NEW YORK

1989

(Please type all information)

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of Dual Coding on Incidental Learning

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PREVIEW

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TABLE OF CONTENTS

Chapter	Page
List of Tables.....	vi
List of Figures.....	vii
Acknowledgements.....	viii
Abstract.....	ix
I. Introduction.....	1
Cognitive Theories of Memory	
Bilingual Memory	
Dual Codes of Memory	
Unresolved Issues and Contrasting Interpretations	
Purpose	
Hypotheses	
II. Methodology.....	29
Participants	
Materials and Equipment	
Stimulus Materials	
Equipment	
Background Information	
Procedure	
Consent Procedure	
Recruitment Procedure	
Experimental Procedure	
Debriefing Procedure	

III.	Results.....	44
	Descriptive Data	
	Multivariate Analyses	
IV.	Discussion.....	59
	Overview of Findings	
	Implications for School Psychology	
	Implications for Learning	
	References.....	68
	Appendices.....	73
	A. The State Education Department, Amendment to the Regulations of the Commissioner of Education, Part 154, Guidelines for Bilingual Education	
	B. English - Spanish Stimulus Word List	
	C. Line Drawings Depicting Word List Stimuli	
	D. Background Information Sheet	
	E. New York City Board of Education Proposal Review Committee Guidelines, Application Letter, Approval Letter	
	F. Administration Consent Letter	
	G. Parental Consent Letter	

LIST OF TABLES

Table	Page
1. Summary of Demographic Data for 89 Participants...	31
2. Descriptive Data for High and Low Verbal Ability Groups.....	44
3. Mean Number of Words Recalled for Each Condition by Verbal Ability.....	45
4. Zero-order Correlations of Age, Grade, Sex, Verbal Ability, Age Learned Second Language, and Recall Scores.....	47
5. Results of 3 x 2 Multivariate Analysis of Variance for High and Low Verbal Groups on Three Recall Measures	49
6. Results of Multiple Regression Analysis Predicting Number of Words Recalled for Bilingual Condition.....	52
7. Results of Multiple Regression Analysis Predicting Number of Words Recalled for Monolingual Condition.....	53
8. Results of Multiple Regression Analysis Predicting Number of Words Recalled for Picture-Word Condition.....	54
9. Results of Multiple Regression Analysis Predicting Number of Words Recalled for Bilingual Condition.....	55

LIST OF FIGURES

Figure	Page
1. Incidental Free-Recall Scores for Three Conditions by Verbal Ability.....	51

PREVIEW

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ABSTRACT

The purpose of this study was to investigate the memory processes involved in verbal learning for bilingual students. According to dual coding theory, (Paivio & Lambert, 1981) bilinguals have separate memory systems for each of their languages and a non-verbal system corresponding to images. The implication of functionally distinct systems is that each may contribute independently to memory and result in superior recall to one coding system. This study predicted that, with verbal ability controlled, bilingual coding, or naming Spanish words in English, would elicit two verbal codes and result in significantly superior recall to monolingual coding. Image coding is assumed to be a stronger mnemonic than verbal coding. Hence a second prediction stated that when verbal and nonverbal codes are activated, as in naming pictures, this would result in significantly superior recall to bilingual or monolingual coding, with verbal ability controlled.

Eighty-nine Spanish-English bilingual high school students were shown a mixed list of 51 slides consisting of 17 pictures, 17 English words and 17 Spanish words. The participants' task was to name the pictures with an English word, to translate the Spanish words with an

English word, and to copy the English words. An unexpected recall task followed.

The results of a multivariate analysis of variance showed that with verbal ability controlled, recall for picture-word coding was significantly higher than for bilingual coding, which in turn was significantly higher than recall for monolingual coding. These findings supported the assumptions that for bilinguals there are two functionally distinct representational systems corresponding to each language, and a third system corresponding to images. Verbal ability was significant only on the bilingual coding task and this has important implications for bilingual learning.

CHAPTER I

INTRODUCTION

The number of bilingual children of school age has greatly increased over the past years, and many of these students demonstrate learning problems and academic delays. Not enough is known about the processes involved in bilingual verbal learning for educators to effectively counteract this trend. The purpose of the present study was to investigate the memory processes involved in verbal learning in order to facilitate learning for bilingual students.

School psychologists and educators have long recognized the importance of language in memory and learning. Generally, verbal learning involves the formation of associations to concepts. Recent evidence, however, suggests that learning and memory in bilinguals is a special area for investigation. Verbal learning in bilingual students may involve cognitive processes that are different from the cognitive processes of students who have one language system. The dual language system of the bilingual student appears to mediate learning differently. The associations to a word in one language, for example, may be different than associations to the translated equivalent of that concept. The word "caldera", for instance, may evoke

different memories and cognitions for a Spanish-American boy who thinks of his mother's cooking rice and beans than the word "kettle" which may remind him of tea.

In the literature on bilingual memory two major theories offer contrasting explanations of bilingual verbal learning. One theory (Pavio & Lambert, 1981) suggests that each language is represented independently as a separate system in memory. On the other hand, others argue that the two languages of a bilingual are represented as one interdependent system in memory (McCormack, 1977). In order to enhance instruction for bilingual students, it is critical to know how verbal codes are used in the acquisition of information, and how information is transferred from one language system to another.

This study was a replication of an investigation by Paivio and Lambert (1981) which provided evidence for three functionally distinct systems of memory representation in bilinguals. According to Paivio and Lambert, bilinguals have separate memory systems for each of their languages and a non-verbal memory system corresponding to images. The present study was designed to provide a more rigorous test for three functionally independent systems of memory representation in bilingual participants.

The review of the literature relevant to the present study focuses on cognitive approaches to memory and bilingualism. The review includes an overview of studies of memory which provide the historical perspective for the current investigation, a summary of research and salient issues in bilingual memory, and an overview of theory and research on dual memory codes. The following chapters present the methodology of the study, the results, and a discussion of the findings.

Cognitive Theories of Memory

This section presents an overview of a number of cognitive theories of memory and is divided into three major parts. The historical emergence of cognitive psychology is presented first. The development of the information-processing paradigm and relevant memory research is presented in the second part, and current theories exploring the nature of semantic memory are discussed in part three.

The Emergence of Cognitive Psychology

Psychological experiments on memory were first done by Ebbinghaus (1885) who developed procedures and methods for the investigation of memory. These early experimental tasks involved simple materials and typically required the memorization of a list of nonsense syllables or unrelated words. The methods

introduced by Ebbinghaus dominated the study of memory and verbal learning for many years. Generally, research in the Ebbinghaus tradition concerned problems such as the conditions governing economy in learning, transfer of training (Postman & Stark, 1964), conditions of forgetting (Peterson & Peterson, 1959), and the acquisition and the retention of different sorts of materials (McGeoch & Irion, 1952).

There is a trend in current theories away from the tradition of analysis and dissection toward memory for wholistic, complex materials. Current research in memory utilizes complex materials such as pictures and stories, materials that reflect the influence of Bartlett (1932), who is credited with being the first cognitive psychologist (Neisser, 1967). Bartlett (1932) formulated concepts and constructs of memory which are influential in current research. He worked with complex materials such as stories and pictures, and found that the use of a verbal code, as opposed to direct visual imagery, enhanced memory for things in a sequential order. He showed his subjects pictures of faces and then asked them to recall the material in any order. He found that the participants who remembered the faces and the names underneath the stimuli made fewer errors in recalling the order of

presentation. These results suggested that there are two methods of recall, one relying on visual images and the other using verbal symbols.

While early work on memory suggested different types of memory representation, it was not until the advent of the computer that the attention of cognitive psychologists turned to questions about how the human organism encodes and transforms incoming information (Neisser, 1967). The next section discusses the emergence of a new paradigm in memory research.

The Information-Processing Paradigm

The principal theoretical paradigm that has been used in studies of memory over the past three decades has been the information-processing model. This view is based upon the idea that the human organism picks up information as it arrives at the sensory receptors. This information is converted, processed by the brain, stored, and retrieved at a later time.

Psychological examination of human attention and memory has focused upon a detailed analysis of how information is processed and stored. An early approach focused on the reception of auditory stimulation. For instance, Broadbent (1958) conducted a series of studies on dichotic listening in which the participants heard

different messages in each ear. In one type of task the participants were asked to repeat the items going into one ear and to disregard the material channeled into the other ear. When the presentations were stopped, the participants did not recall the material presented into the disregarded ear. Only the material that had been attended to was retained for any length of time. Based on these studies, Broadbent formulated a model in which memory was viewed as having a finite capacity for information and which consisted of filtering mechanisms and a short-term memory store.

Accordingly, memory has been classified into three levels of storage, a sensory store, a short-term memory and a long-term memory. The short-term store has a limited capacity while long-term memory has no known limit (Murdock, 1967). Many verbal learning experiments have produced data that supports this distinction between systems (Postman & Phillips, 1965; Waugh & Norman, 1965).

Current Theories

Memory research in the 1980's involves new theoretical models in which memory is viewed as a continuous process rather than as a static entity with short- and long-term stores. Craik and Lockhart (1972) proposed that memory ranges along a continuum from

transient perceptions to highly durable products of perception. The difference between what is briefly retained and what is more permanently retained depends on the degree of cognitive activity involved in encoding the information. For instance, to remember a phone number one may rehearse a string of digits. Once rehearsal stops, however, the numbers may not be retained. On the other hand, when cognitive activity on incoming information involves an elaboration of its meaning into an associative network of existing information, it is better retained (Smith, Sarason, & Sarason, 1981).

The view of memory as a by-product of cognitive processes has led to an increased interest in the encoding processes. It has led to the question of how meaningful or semantic information is stored or represented in memory.

Cognitive psychologists have designed models of semantic memory based on the notion that human beings process information and record it in memory in an abstract or symbolic fashion (Anderson & Bower, 1973). After a stimulus fades away, it is replaced by an abstraction, a memory that includes only the meaning of an event. For instance, one sees the word "man" and remembers the concept but not the look or sound of the

word. The basic idea is that information is represented in memory in terms of propositions (Smith, Sarason, & Sarason, 1981). A proposition is defined as the smallest unit about which one can make a true or false statement. One unit of information is connected to other units by a set of rules. Much of the material that human beings remember seems to be recorded in such an abstract fashion (Simon, 1979).

Collins and Quillian (1969) suggested that propositions or concepts in memory are connected by links in a complex, hierarchical network. Evidence for this type of human memory system has been provided by search time studies where participants were asked very simple questions to see how much time it took them to respond. Response time was less for concepts that were directly linked than for concepts less directly connected. For instance, respondents answered "yes" more quickly to the query, "Is a canary yellow?" than to the question, "Does a canary eat?" Computer simulations of human mental activity have been designed based on such propositional networks (Simon, 1979).

Anderson and Bower (1973) and Kintsch (1974) provided major descriptions of a propositional format. They defined propositions as abstract symbolic structures which expressed relationships between

different entities. Anderson and Bower (1973) attempted to show that a single type of memory code, propositions, accounted for all memory representations. Such propositional codes are abstract and not related to a particular sense such as vision or hearing, nor to the modality from which the information came.

In the 1980's psychologists have begun to study memory for a wide variety of complex materials such as pictures and verbal passages in different languages. The findings have suggested that memory may be visually coded, verbally coded, or dually coded (Paivio, 1986). In contrast to propositional models, this line of research emphasizes the importance of visual codes in the storage and retrieval of information. Research with bilingual individuals suggests that memory effects may be not only modality-specific but language-specific (Kolars & Brisbon, 1984).

Bilingual Memory

This section presents current research on bilingual memory and is divided into three major parts. A typology of bilinguals is presented first. Two alternate theories on the nature of bilingual memory representation are discussed in parts two and three.

Compound and Coordinate Bilinguals

Differences in language acquisition history have been used to classify bilinguals into coordinate and compound types (Ervin & Osgood, 1954). A compound bilingual is defined as one who learned a second language directly while a coordinate is defined as one who learned a second language by means of the first. When the parents speak two languages, it is likely that both languages will refer interchangeably to the same environmental events. The children thus develop a compound relationship between the languages. On the other hand, experience in two distinctive linguistic settings may lead to greater separation of memory representations, leading to a coordinate relationship between the languages.

Lambert, Havelka, and Crosby (1958) tested groups of bilinguals using semantic rating scales. Semantic differences of translation equivalents were less for the compound than for the coordinate bilinguals. Those bilinguals who had learned both languages early in life found French and English translation equivalents to be more similar than did those bilinguals who learned the languages at different times. The evidence suggested that the bilinguals who acquired a second language later, in contrast to the bilinguals who acquired both