

AN ABSTRACT OF THE THESIS OF

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High visual imagery has been characterized as a major component of successful autobiographical recall of events (Brewer, 1988; Galton, 1880; White, 1989). The present study was an attempt to ascertain if visual imagery had differential effects on autobiographical recall for personal episodic, personal semantic, and nonpersonal semantic information. Thirty undergraduate volunteers (15 high and 15 low imagers) were extracted from a pool of 50 subjects because they scored in excess of $\pm .5$ standard deviation on Bett's Questionnaire Upon Mental Imagery (Sheehan, 1967). Using time periods (preschool, primary school, and secondary school) as cues, autobiographical recall was operationalized as the number of items recalled, in 90 seconds, for personal episodic and personal semantic information. The nonpersonal semantic recall of vegetables and adjectives was time period nonspecific. The statistical analysis revealed significant time period main effects for personal episodic and personal

semantic recall. More items from secondary school were recalled relative to primary or preschool, regardless of visual imagery. In addition, there was a significant nonpersonal semantic recall x category interaction supporting the hypothesis that high relative to low imagers would have less recall of adjectives. The lack of a visual imagery x time period interaction does not support the hypothesis that high visual imagery is a necessary component of successful autobiographical memory recall. The results are discussed from the perspective of Paivio's (1986) dual code theory.

AUTOBIOGRAPHICAL RECALL AND VISUAL IMAGERY

A Thesis

Presented to

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In Partial Fulfillment

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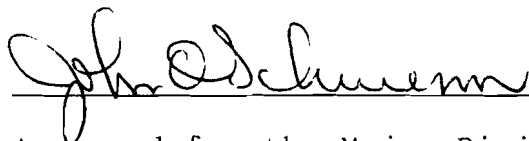
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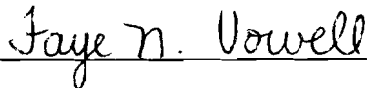
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TABLE OF CONTENTS

CHAPTER I:	INTRODUCTION.....	1
CHAPTER II:	METHOD.....	14
	Subjects.....	14
	Design.....	14
	Materials.....	15
	Procedure.....	16
CHAPTER III:	RESULTS.....	19
CHAPTER IV:	DISCUSSION.....	31
REFERENCES.....		36
APPENDICES.....		41
	A - Consent Form/Demographic Questionnaire.....	42
	B - Questionnaire Upon Mental Imagery (Sheehan, 1967)..	43
	C - Headings on Autobiographical Recall Sheets.....	48
	D - Script of Instructions.....	50

LIST OF TABLES

Table 1: Visual Imagery x Time Period Analysis of Variance
Personal Episodic Recall for Events.....21

Table 2: Means and Standard Deviations
Number of Items Recalled in Personal Episodic
Category for Events.....22

Table 3: Visual Imagery x Time Period Analysis of Variance
Personal Semantic Recall for Caregivers'/Teachers'
Names.....23

Table 4: Means and Standard Deviations
Number of Items Recalled in Personal Semantic
Category for Caregivers'/Teachers' Names.....24

Table 5: Visual Imagery x Time Period Analysis of Variance
Personal Semantic Recall for Friends' Names.....26

Table 6: Means and Standard Deviations
Number of Items Recalled in Personal Semantic
Category for Friends' Names.....27

Table 7: Visual Imagery x Category Analysis of Variance
Nonpersonal Semantic Recall for Vegetables
and Adjectives.....28

Table 8: Means and Standard Deviations
Number of Items Recalled in Nonpersonal Semantic
Category for Vegetables and Adjectives.....29

LIST OF FIGURES

Figure 1: Visual Imagery x Nonpersonal Semantic
Recall Interaction.....30

CHAPTER I

INTRODUCTION

Autobiographical memory refers to memories of life experiences related to the self (Brewer, 1988; Robinson, 1986). Autobiographical event memories (e.g., personal episodic memory) are the equivalent of episodic memory, whereas autobiographical facts (e.g., personal semantic memory) represent the counterpart of semantic memory (Robinson & Swanson, 1990). "Personal episodic information refers to single incidents, while personal semantic information is information repeatedly experienced by the subject (e.g., one's name)" (Dritschel, Williams, Baddeley, & Nimmo-Smith, 1992, p. 133). Without autobiographical memory, people would have no way of knowing who they are, who others are, what the world is like, or what to expect from life (Bruhn, 1990).

Methodologies for studying autobiographical memory have been criticized because of their constraints such as retrieval bias due to specific cues (Dritschel et al., 1992) and lack of generalizations from using only one subject (Brewer, 1988). Examining these methodologies will illuminate the strengths and weaknesses of each.

Review of Methodologies

Cue Word Techniques

The beginnings of research on autobiographical memory can be traced to Sir Francis Galton (1880). An interest in personal recollections prompted Galton to develop two different techniques, the breakfast questionnaire and the word technique. Galton's (1880) breakfast questionnaire consisted of asking subjects to recall, in the afternoon, the appearance of their breakfast tables from that morning.

Galton's (1880) word technique has proven to be a more enduring methodology than the breakfast questionnaire. In this technique, Galton read a word to a subject who was then instructed to recall memories while Galton recorded them on paper. The technique was not intended to be strictly a test of autobiographical memory, but as an open-ended examination of the mind.

Despite Galton's foray into the investigation of personal recollections, researchers waited almost 100 years until the "cognitive revolution" before pursuing the topic once again. Crovitz and Schiffman (1974) modified Galton's word technique by asking subjects to "think of a specific memory associated with each word" (Crovitz & Quina-Holland, 1976, p. 61). The dependent variables using the Crovitz technique are latency to

generate a specific memory and the age of the memory in years.

Diary Methodologies

The Linton Technique. Linton (1975) conducted a study of her own autobiographical memory. Each day over a six-year period she selected between two and five of the most memorable daily events, rated them on dimensions relevant to memorability (e.g., emotionality and datability), and transcribed them onto index cards. This technique allowed her to maintain veridical records of autobiographical events. She then used partial information (e.g., the information on only one of the index cards) from the initial event in a cued-recall procedure. At the end of each month, Linton measured her capacity to recognize, sequence, and date records selected randomly from previous months.

Wagenaar's Single Case Diary. Like Linton, Wagenaar (1986) conducted a six-year, longitudinal study of his autobiographical memory by recording one or two events each day in his diary. The incidents were recorded according to the criteria of "who, what, where, and when." In addition, he rated each incident's unusualness and pleasantness and assessed his own emotional involvement.

Using 2,400 incidents, Wagenaar (1986) tested his memory by spacing recall over a 12 month period. He

cued himself with one piece of information and attempted to recall the rest. By randomizing the order of who, what, where, and when questions he examined the importance of those four aspects of each incident.

The Brewer Technique. In an attempt to avoid having the experimenter as the only subject, Brewer (1988) modified the Linton (1975) and Wagenaar (1986) single subject techniques in several ways. First, he included a larger sample size, fitting 10 subjects with a beeper that went off at random intervals approximately once every two hours over a 13 day period. Second, he requested much more information. When prompted by the beeper, subjects were instructed to record the time (day of week, date, time), location, thoughts, emotions, actions, and thought/action coordination. Following the 13 day data collection period, each subject was tested at three time intervals: immediately after acquisition, at a mean of 23 days after the end of acquisition, and at a mean of 46 days after the end of acquisition. Subjects were tested using five types of cues: time, location, time and location, thought, and action. Subjects were provided with a single cue and then asked to recall the remaining information about the event. After the recall, subjects filled out a 7-point scale giving a rating of their overall memory for the event. They

then completed seven, 7-point scales designed to measure their visual, auditory, tactile, smell, taste, emotion, and thought phenomenal experiences during recall.

Autobiographical Fluency Task

Dritschel et al. (1992) modified the Crovitz (1974) word technique by including a structured interview which requested both episodic and semantic memories from specific periods in a subject's life. In their study, subjects were given a specific time period and asked to recall specific events (personal episodic memory) followed by names of friends and teachers (personal semantic memory) they knew from the same period. For purposes of comparison, subjects were then instructed to generate items from four nonpersonal semantic categories (vegetables, animals, United States presidents' names, and British prime ministers' names). Subjects were allowed 90 seconds to complete all recall before being given a different time period and repeating the three recall tasks. The dependent measure was the number of items remembered within 90 seconds in each category.

Review of Results

Cue Word Techniques

Breakfast Questionnaire. Most subjects reported using strong visual imagery in accomplishing the task

(Galton, 1880). The main limitations of the breakfast questionnaire were verification (e.g., validating the accuracy of descriptions) and the limited data obtained by the procedure. For these reasons, the breakfast questionnaire has been abandoned as a method for studying autobiographical memory.

Word Techniques. In the original Galton (1880) experiment, the open-ended nature of the task resulted in subjects' responses including many different types of memory. In addition, verification was a problem. Galton's curiosity never allowed him to dwell on any topic for long (Brewer, 1988) and he abandoned the pursuit of personal recollections before resolving the methodological problems.

Results of experiments using the Crovitz (1974) technique primarily demonstrate the specificity in time and space of events (Rabbit & Winthorpe, 1988; Robinson, 1976; Rubin, 1982; Rubin, Wetzler, & Nebes, 1986) and the declining frequency of autobiographical recalls as a function of their age (Crovitz & Schiffman, 1974). Some experimental limitations pervade the technique, however. First, the obtained memories may be recollections of more generic information rather than unique episodes from the subject's past (Brewer, 1988). Second, subjects may recollect one particular or atypical portion of their

lives (Koppelman, Wilson, & Baddeley, 1989; McCormak, 1979). Third, the personal memories may not be the same as original experience (Brewer, 1988).

Diary Methodologies

Results from Linton's experiment (1975) indicated little or no forgetting after one year; after two years, Linton reported approximately 89% correct. Her detailed written accounts of earlier events allowed easy verification. Additionally, most events remembered were not associated with strong affective cues; thus, some events rated high in emotionality were forgotten. Since Linton served as both subject and examiner she could not present herself with "false memories." However, the use of the experimenter as the subject is one of the primary criticisms of the Linton technique because the results are not generalizable to a larger population (Brewer, 1988).

Wagenaar's results (1986) found that who, what, and where, but not when, were effective retrieval cues. Perhaps storage of temporal information does not provide ready access to event recall. Additional findings included better retention for unusual than usual items and poorer short-term than long-term recall for unpleasant items. He also forgot less than Linton (1975); 96% correct after two years compared to her 89% correct.

These two diary methodologies have some serious shortcomings. Collecting data is very slow and demanding, the studies only address the memory of a single subject, and experimentally testing particular hypotheses is difficult because the studies are essentially observational.

Brewer (1988) circumvented these methodological problems by using a larger sample and requesting more detailed responses than either of the aforementioned studies. The Brewer methodology (1988) produced some noteworthy results:

1. Rare in contrast to common locations are better recalled.
2. Autobiographical recalls with high confidence are virtually always accompanied by high visual imagery. Accurate recalls are also associated with high visual imagery.
3. As also reported by Wagenaar (1986), autobiographical memory typically contains information about actions (who), thoughts (what), and locations (where), but rarely about absolute time (when).
4. Much of the data from this study can be accounted for by the hypothesis that recall of autobiographical information is directly related to the distinctiveness of the representation.

Brewer (1988) expanded this fourth result to explain how certain representations become more distinctive and others become non-distinctive. Several investigators (e.g., Bower, 1974; Brewer & Pani, 1983; Hintzman, 1978) have proposed that repetition increases the strength of semantic information, while decreasing the strength of episodic information. Brewer (1988) has labeled this phenomenon the "dual-process theory of repetition" which asserts that with repetition, semantic information increases in strength, and episodic information decreases in strength. Perhaps repetition produces a large number of similar representations so any particular one is not distinctive.

Autobiographical Fluency Task

Results of the Dritschel et al. (1992) study show a trend for both components of the autobiographical fluency task (personal episodic and personal semantic) to show positive correlations with nonpersonal semantic memory performance. In addition, some subjects were more fluent than others and the degree to which a subject was fluent in one category (i.e., personal episodic, personal semantic, or nonpersonal semantic) was matched by a similar degree of fluency in other categories.

Cluster analysis revealed that retrieving names of animals and politicians (i.e., a nonpersonal semantic task) was distinct from recalling names (i.e., a

personal semantic task) and events (i.e., an episodic task). This difference is striking given that subjects produced episodic and semantic memories from a specific lifetime period before proceeding to the next lifetime period. Thus, memory did not dissociate according to lifetime periods, "rather, it showed dissociation (for all lifetime periods) between episodes and personal semantic information, with both being distinguished from general nonpersonal semantic information" (Dritschel et al., 1992, p. 139). However, this result may reflect an aspect of memory organization or the usage of different retrieval strategies.

Summary

Brewer's (1988) and Dritschel et al.'s (1992) results have been explained using the semantic memory/episodic memory structural model proposed by Tulving (1972, 1984, 1985). However, based on this model no dissociation should exist between personal semantic and nonpersonal semantic memory. Yet, Dritschel et al.'s (1992) results indicate otherwise. This deviation from the Tulving episodic/semantic perspective can be reconciled by Barsalou (1988). Instead of dichotomizing episodic and semantic memories (Tulving, 1972, 1984, 1985), viewing them on a continuum (Barsalou, 1988) may be more appropriate.

Barsalou (1988) proposes:

At one end are specific episodes (e.g., going to an Indian restaurant on one's 30th birthday). Next are those summarized events that were abstracted from a few highly specific and similar events (e.g., going to Indian restaurants on one's birthdays). Next are summarized events that were abstracted from events that have occurred often (e.g., going to Indian restaurants). Finally at the far end is relatively stable and abstract knowledge that may be culturally shared to a large extent (e.g., going to restaurants). (p. 204)

Dritschel et al.'s (1992) results partially support Barsalou's sequential progression from specific events (personal episodic) to culturally shared knowledge (nonpersonal semantic). They reported two distinct clusters of memories, personal memories and nonpersonal semantic memories, with personal semantic memories being distinct from personal episodic memories within the personal memories cluster.

Conceptualizing autobiographical memory in terms of structure is useful, but resolving the ambiguity requires a more comprehensive approach that includes the processes involved within autobiographical memory. High visual imagery seems conducive to high personal episodic recall (Brewer, 1988; Galton, 1880; Rubin,

1980; White, 1989). The most extensive study was conducted by Brewer (1988) whose results indicated that subjects reported using high levels of visual imagery while use of other modalities (e.g., auditory, tactile, smell and taste) varied. Recall in the Brewer study (1988) was limited entirely to personal episodic memory. Thus, examining other imagery modalities in relation to personal episodic and personal semantic memory was not possible.

High visual imagery facilitates personal episodic memory. Conversely, semantic memory, whether conceptualized as associative network (Collins & Loftus, 1975), feature set (Smith, Shoben, & Rips, 1974), or propositional network (Anderson, 1976, 1983) is verbally based.

The present study will attempt to determine the degree to which personal episodic, personal semantic, and nonpersonal semantic memories are a function of imagery. The following two hypotheses will be tested: a) subjects with high relative to low visual imagery will have higher personal episodic recall, and b) subjects with high relative to low visual imagery will have lower nonpersonal semantic recall for adjectives. In addition, the present study will attempt to answer the following research question: will subjects with

high relative to low visual imagery have higher
personal semantic recall?

CHAPTER II

METHOD

Sample

Subjects were 50 volunteer psychology students from a midsized university located in the midwest. Five points of extra credit were awarded for participation.

Design

The study has a 2 (Visual imagery: high or low) x 3 (Time period: preschool, primary school, and secondary school) mixed factor design for the personal episodic and personal semantic components. Visual imagery is a between-subjects independent variable and the time periods are a within subjects independent variable. A 2 (Visual imagery: high or low) x 2 (Nonpersonal semantic recall: vegetables and adjectives) mixed factor design was used for the nonpersonal semantic categories. Following Dritschel et al. (1992), dependent variables will be recall of personal episodic (i.e., events), personal semantic (i.e., names of friends and teachers), and nonpersonal semantic memories (i.e., names of vegetables and adjectives) operationalized as the number of items recalled in a 90 second period.

Materials

Consent and Demographic Form. A consent form (see Appendix A) was typed on a sheet of 8 1/2 x 11" white typing paper. The form included four demographic questions.

Betts Questionnaire upon Mental Imagery.

Sheehan's (1967) revision of Betts' (1909) Questionnaire upon Mental Imagery (QMI) was used to assess levels of imagery. The QMI (see Appendix B) consists of 35 statements that assess vividness of mental images in the seven sensory modalities: visual, auditory, cutaneous, kinesthetic, gustatory, olfactory, and organic. Both subscores and a total score can be obtained. The statements are randomly arranged with the restriction that adjoining items do not elicit responses from the same sensory modality. Each statement is followed by a rating scale ranging from perfectly clear and as vivid as the actual experience (1) to no image present at all, you only "know" that you are thinking of the object (7). A lower score denotes higher levels of mental imagery. The QMI has demonstrated adequate test-retest reliability (.74) and a Cronbach's Coefficient Alpha of .94 (Westcott & Rosenstock, 1976). To provide sufficient heterogeneity between high versus low imagers, only subjects beyond

.5 standard deviation of the mean were included in the sample.

Autobiographical Fluency Task. The autobiographical fluency task (Dritschel et al., 1992) was used to measure autobiographical recall. Personal memory was measured by requesting events, caregivers'/teachers' names, and friends' names from the lifetime periods of preschool (before age 5), primary school (age 5 - 12), and secondary school (age 13 - 18), typed in large bold print at the top of sheets of 8 1/2 x 11" white typing paper for subjects' responses (see Appendix C). Following completion of the personal memory response sheets, two nonpersonal semantic categories (i.e., names of vegetables and adjectives) were measured in the same manner (see Appendix C).

The forms were pre-assembled into a packet in the following order: consent and demographic form, QMI, and autobiographical recall response sheets. Pages of each individual packet were numbered on the upper left corner of each page for identification and subject anonymity. The pages were numbered sequentially in the upper right corner.

Apparatus. A stopwatch was used to measure 90 second intervals.

Procedure

The experimenter, a 36 year-old male, briefly described the subsequent activities to intact classes of introductory psychology (see Appendix D for the script). After answering all questions, packets were distributed. Subjects were instructed to read and sign the consent form and complete the demographic questions. Subjects were also be told not to turn to the next page until instructed to do so. Next, subjects were instructed to turn to page 2. The instructions to the QMI were read aloud by the experimenter while subjects silently read along. After all questions were answered, subjects were instructed to turn to page 3 and complete the two page QMI.

After completion of the QMI, subjects were instructed to turn to page 5 which consisted of an autobiographical recall response sheet (see Appendix C) with the words "Preschool (before age 5) -- Events" printed in large bold characters at the top of the page. Subjects were instructed to recall and write down as many items as possible after they were told to begin and to place their pencil on the table and remain seated quietly if they finish responding. The experimenter instructed the subjects to "begin" while simultaneously starting the stopwatch. After 90 seconds, the experimenter instructed the subjects to

"stop." This procedure continued until all lifetime periods and categories had been presented. When all subjects were finished, the experimenter gathered the materials, thanked the subjects for their participation, and debriefed them.

CHAPTER III

RESULTS

The present study was designed to assess the differential effects of visual imagery on personal episodic, personal semantic, and nonpersonal semantic recall. The overall mean score on the visual subscale of the QMI was 11.88 with a standard deviation of 3.88. Thus, the 20 subjects who scored within $\pm .5$ standard deviation (9.94 to 13.82) of the mean were excluded, and the remaining 30 subjects (15 high and 15 low imagery) were included in the final analyses.

Personal episodic recall was operationalized as the number of events remembered in 90 seconds for each of the three time periods, preschool, primary school, and secondary school. Per Dritschel et al. (1992), personal semantic recall was measured once as the number of caregivers'/teachers' names remembered and again as the number of friends' names reported. Separate 2 (Visual imagery: high or low) x 3 (Time period: preschool, primary school, and secondary school) mixed factor analyses of variance were performed on each of the three dependent variables. Nonpersonal semantic recall was analyzed using a 2 (Visual imagery: high or low) x 2 (Nonpersonal

semantic recall: vegetables and adjectives) mixed factor analysis of variance. Follow up analysis, when appropriate, was done using Fisher's least significant difference (LSD) test set at the .05 level. The results of the analyses of variance performed on the personal episodic, personal semantic, and nonpersonal semantic recall are presented in Tables 1, 3, 5 and 7, respectively, with means and standard deviations presented in Tables 2, 4, 6 and 8, respectively.

Personal Episodic and Personal Semantic Recall

Analysis of variance for personal events (see Table 1) revealed a statistically significant main effect for time period, $F(2, 84) = 6.27, p < .005$. The LSD revealed recall of events in secondary school ($M=8.60$) was substantially higher than either preschool ($M=5.83$) or primary school ($M=6.16$), the latter two means did not differ.

Analysis of variance for caregivers'/teachers' names (see Table 3) also revealed a statistically significant main effect for time period, $F(2, 84) = 24.34, p < .001$. A LSD test performed on the three means revealed more teachers' names from secondary school ($M=11.80$) were recalled than preschool caregivers' names ($M=6.80$) or primary school teachers' names ($M=7.00$), the latter two means did not differ.

Table 1Visual Imagery x Time Period Analysis of VariancePersonal Episodic Recall for Events

SOURCE OF VARIATION	DF	SS	MS	F
Visual Imagery (V)	1	12.84	12.84	1.18
Time Period (T)	2	136.87	68.43	6.27*
V x T	2	9.62	4.81	.44
Error	84	917.07	10.92	

*p < .005

Table 2Means and Standard DeviationsNumber of Items Recalled in Personal Episodic Category
for Events

	<u>Time Period</u>			
	Preschool	Primary School	Secondary School	Total
<u>Imagery</u>				
High	6.60	6.13	9.00	7.24
	(4.45)	(1.92)	(2.77)	(3.22)
Low	5.07	6.20	8.20	6.49
	(1.91)	(3.12)	(4.57)	(3.38)
Total	5.83	6.16	8.60	6.86
	(3.42)	(2.92)	(4.26)	(3.58)

Table 3

Visual Imagery x Time Period Analysis of Variance
Personal Semantic Recall for Caregivers'/Teachers'
Names

SOURCE OF VARIATION	DF	SS	MS	F
Visual Imagery (V)	1	4.90	4.90	.48
Time Period (T)	2	477.76	238.88	24.34*
V x T	2	19.40	9.70	.99
Error	84	824.27	9.81	

*p < .001

Table 4Means and Standard DeviationsNumber of Items Recalled in Personal Semantic Category forCaregivers'/Teachers' Names

	<u>Time Period</u>			
	Preschool Caregivers	Primary School Teachers	Secondary School Teachers	Total
<u>Imagery</u>				
High	6.87	6.80	12.67	8.72
	(2.33)	(1.93)	(4.56)	(4.01)
Low	6.73	7.27	10.93	8.31
	(2.25)	(2.84)	(3.97)	(3.10)
Total	6.80	7.00	11.80	8.53
	(2.82)	(2.43)	(5.35)	(3.13)

Analysis of variance for friends' names (see Table 5) revealed a significant main effect for time period, $F(2, 84) = 71.19$, $p < .001$. The LSD test revealed the number of friends' names recalled from secondary school ($M=19.45$) was higher than primary school ($M=14.76$) which was higher than preschool ($M=4.73$). Additionally, the number of friends' names recalled from secondary school was significantly higher than primary school.

Nonpersonal Semantic Recall

A 2 (Visual imagery: high or low) x 2 (Nonpersonal semantic recall: vegetables and adjectives) mixed factor analysis of variance (see Table 7) revealed a significant interaction $F(1, 56) = 4.36$, $p < .05$. Mean comparisons revealed that high visual imagery resulted in lower recall for names of adjectives ($M=15.73$) than low visual imagery ($M=21.93$). Figure 1 shows the two-way interaction to be slightly disordinal.

Table 5Visual Imagery x Time Period Analysis of VariancePersonal Semantic Recall for Friends' Names

SOURCE OF VARIATION	DF	SS	MS	F
Visual Imagery (V)	1	.92	.92	.04
Time Period (T)	2	3384.85	1692.43	71.19*
V x T	2	6.79	3.40	.14
Error	84	1996.88	23.77	

*p < .001

Table 6

Means and Standard DeviationsNumber of Items Recalled in Personal Semantic Category forFriends' Names

	<u>Time Period</u>			
	Preschool	Primary School	Secondary School	Total
<u>Imagery</u>				
High	4.27	14.73	19.64	12.88
	(2.08)	(5.05)	(7.23)	(5.23)
Low	5.20	14.80	19.25	13.08
	(2.34)	(4.19)	(6.18)	(4.51)
Total	4.73	14.76	19.45	12.98
	(2.69)	(5.86)	(8.44)	(6.13)

Table 7Visual Imagery x Category Analysis of VarianceNonpersonal Semantic Recall for Vegetables and Adjectives

SOURCE OF VARIATION	DF	SS	MS	F
Visual Imagery (V)	1	126.15	126.15	3.37
Category (C)	1	277.35	277.35	7.40**
V x C	1	163.35	163.35	4.36*
Error	56	2098.13	37.47	

*p < .05

**p < .01

Table 8Means and Standard DeviationsNumber of Items Recalled in NonpersonalSemantic Category for Vegetables and Adjectives

	<u>Category</u>		
	Vegetables	Adjectives	Total
<u>Imagery</u>			
High	14.73	15.73	15.23
	(4.56)	(8.76)	(6.98)
Low	14.33	21.93	18.13
	(3.11)	(6.53)	(5.11)
Total	14.53	18.83	16.68
	(3.90)	(7.72)	(6.11)

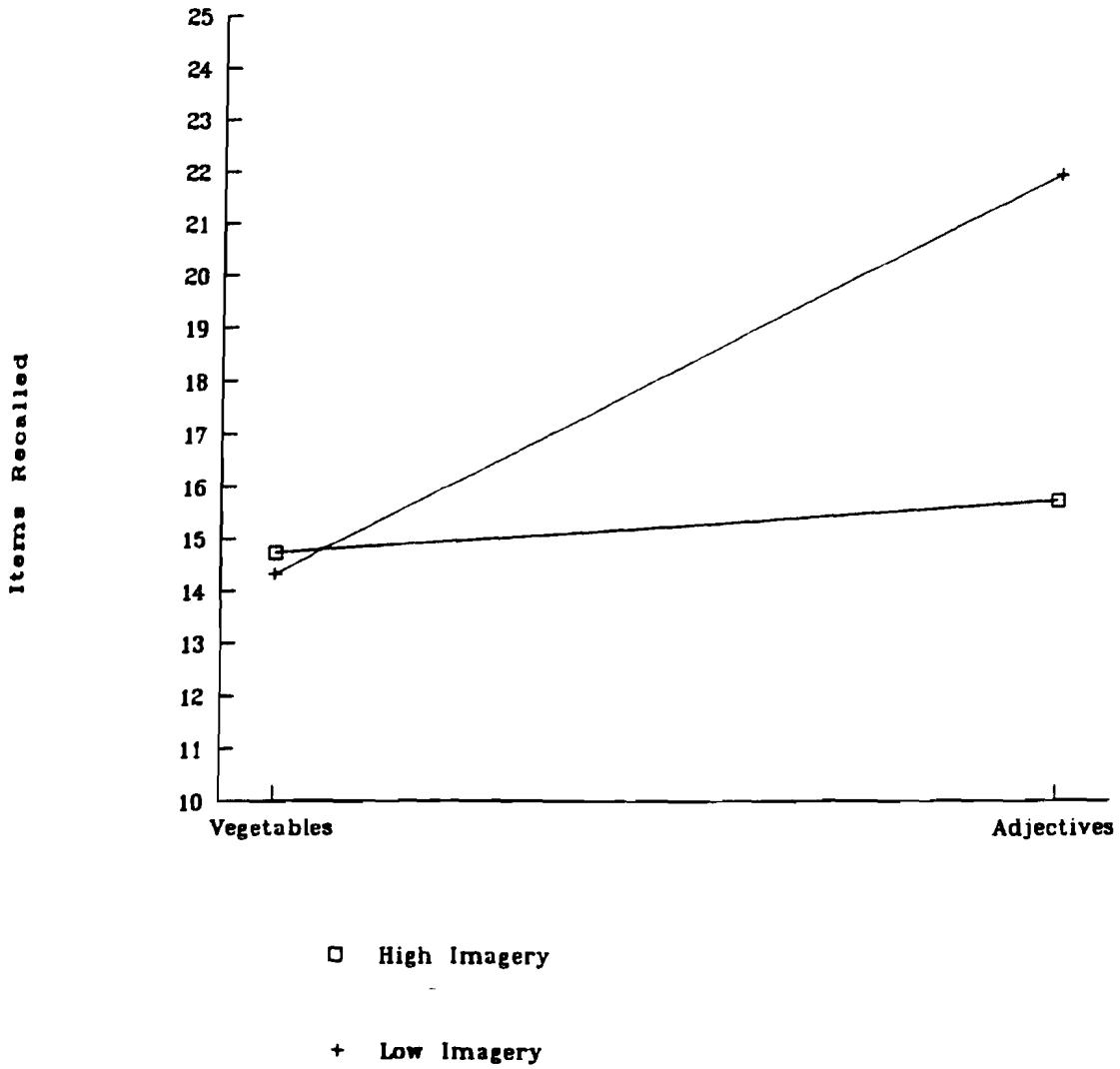


Figure 1. Visual Imagery x Nonpersonal Semantic Recall Interaction.

CHAPTER IV

DISCUSSION

One prediction derived from previous research is that successful personal episodic recall involves the use of visual imagery (Brewer, 1988; Galton, 1880; White, 1989). Since vision is both the dominant and most complex modality of perception, it might be expected to be the richest modality in remembering as well (Robinson & Swanson, 1990). The present study modified Dritschel et al.'s (1992) methodology to ascertain whether visual imagery had differential effects on autobiographical memory (i.e., personal episodic and personal semantic recall) and nonpersonal semantic memory.

Besides manipulating visual imagery, the Dritschel et al. (1992) methodology permitted the investigation of personal episodic, personal semantic, and nonpersonal semantic items. Previous research finding high visual imagery only examined personal episodic recall. Also, the construct validity of high and low visual imagery was strengthened by only including subjects who met specified criteria.

The results of the present study do not support the first hypothesis that high visual imagery is a

necessary component of successful autobiographical memory recall. Neither personal episodic recall nor personal semantic recall were significantly greater for high relative to low imagery subjects. Thus, a subject's level of visual imagery does not appear to influence the **number** of autobiographical recalls; however, it may influence the **accuracy** of recall.

Brewer (1988) reported that accurate, confident recall was greater for high visual imagers. However, none of the subjects were tested beyond 149 days of the event's occurrence. Recalling these incidents may not involve high visual imagery if more time were allowed to pass. In addition, the source of visual imagery explored by Brewer is unclear. Is it directly retrieved as an aspect of original experience, or a construction based on memorial inference (McCauley, 1988)?

The main effect of time period for personal episodic and personal semantic recall conforms to the temporal gradient found by Dritschel et al. (1992). While this result may reflect the recency effect found in more traditional memory experiments, category size is a more likely explanation. For example, one would be expected to have more teachers in secondary school than in primary school. Additionally, the social sphere becomes increasingly larger as a child

progresses from preschool to secondary school. As a result, the number of potential events and friends increases accordingly.

The most perplexing result is the lack of a difference between high and low imagers in recall of vegetables while significantly more adjectives were recalled by low imagery subjects. These two semantic category superordinates were specifically chosen because vegetables, as concrete nouns, are associated with high visual imagery while adjectives are not. However, this result supports the second hypothesis that high relative to low imagers will have less recall of adjectives.

The results of this study can best be accommodated in the context of Paivio's dual code theory (Paivio, 1986). Dual code theory assumes that visual and verbal information are encoded in two independent but related memory systems with the distinct possibility that processing occurs in different hemispheres of the brain. Any event or object which can be visualized can be stored in an imaginal code, and any event or object that can be described can be stored in a verbal code. Moreover, most events can be stored in either an imaginal code, verbal code, or both. However, concrete words (e.g., vegetables) can be encoded imaginally and

verbally, whereas abstract words (e.g., adjectives) can only be encoded verbally (Paivio, 1986).

One assumption of dual code theory is that response latency will be faster when dual coded concrete words are recalled since the probability of retrieving one of the two codes is higher than if only one code were available (Ellis & Hunt, 1989). While the results of the present study appear to violate this assumption, response was measured as the total number of items generated in a 90 second period, and not the speed with which recall took place. The lack of difference in recall between high and low imagers for vegetables is likely due to the finite category size. It is possible that high and low imagers both recalled the entire category of vegetables known to them. In contrast, the category of adjectives contains more items than can be recalled in a 90 second period. Future research should either use categories of similar size, or manipulate the amount of time allowed for recall.

Within this framework, having low imagery skills seems unlikely as a precursor to superior recall of adjectives. Subjects having low imagery may possess higher levels of verbal fluency. Thus, the nature of the present task might favor verbal ability as a potential mediator.

The relationship between autobiographical memory and the episodic/semantic memory distinction is not clear. As Barsalou (1988) proposes, semantic memory represents an accumulation of large numbers of personal episodic experiences which have lost their spatial and temporal specificity but is not a separate memory system as Tulving (1984, 1985) suggests.

Currently, no independent means of deciding whether recalled information comes from episodic or personal semantic memory exists. Until such a means becomes available, the episodic/semantic memory distinction within autobiographical memory remains nebulous.

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APPENDIX A

Consent Form and Demographic Questionnaire

Please read the following statements and, if you agree with them, sign your name in the appropriate place.

I agree to participate in a study conducted by Charles M. Huffman. The purpose of this study is to investigate human memory. As part of the procedure, I will be asked to recall certain aspects of my past. I am aware that I can discontinue participation in this study at any time.

I realize that approximately twenty minutes of my time will be required for participation in this study. I understand that my confidentiality will be respected and neither my name nor any identifying data will be used in any report of this research.

Having considered the above factors, I hereby consent and agree to participate in the study.

Signature of participant

Please complete the following:

. Age: _____

. Gender: Female _____ Male _____

. Did you change schools while in elementary school?

Yes _____ No _____

If "Yes", how many times? _____

. Did you change schools while in junior or senior high?

Yes _____ No _____

If "Yes", how many times? _____

APPENDIX B

Questionnaire of Mental Imagery

Instructions:

The test contains 35 items. Please read each item carefully and then rate the vividness of the mental image that is formed for each item, using the following rating scale:

- 1-Perfectly clear and as vivid as the actual experience
- 2-Very clear and comparable in vividness to the actual experience
- 3-Moderately clear and vivid
- 4-Not clear or vivid but recognizable
- 5-Vague and dim
- 6-So vague and dim as to be hardly discernible
- 7-No image present at all, you only "know" that you are thinking of the object

For example, if you rate your mental image as "vague and dim," then you would give it a rating of 5. Record your answer in the brackets provided after each item. Before you turn to the items on the next page, familiarize yourself with the seven different categories on the rating scale, and pick only one when judging the vividness of each image. A copy of the rating will be printed on each page. Please do not turn to the next page until you have completed the items on the page you are doing, and do not turn back to check on other items you have done. Complete each page before moving on to the next page. Judge each item separately, and not based on how you have judged the previous items.

An example of an item on the test would be one which asked you to consider your mental image of a red apple. If your visual image was moderately clear and vivid you would check the rating scale and mark "3" in the brackets as follows:

Item	Rating
5. Seeing, a red apple	[3]

Now turn to the next page when you have understood these instructions, and begin the test.

- 1-Perfectly clear and as vivid as the actual experience
 2-Very clear and comparable in vividness to the actual experience
 3-Moderately clear and vivid
 4-Not clear or vivid but recognizable
 5-Vague and dim
 6-So vague and dim as to be hardly discernible
 7-No image present at all, you only "know" that you are thinking of the object

Item	Rating
1) Seeing, a relative or friend walking toward you.	[]
2) Feeling, the prick of a pin.	[]
3) The feeling in your body, reaching up to a high shelf.	[]
4) Tasting, your favorite soup.	[]
5) Smelling, roast beef.	[]
6) The sensation of, hunger.	[]
7) Smelling, an ill-ventilated room.	[]
8) Feeling, sand.	[]
9) The sensation of being full, as from a very big meal.	[]
10) Tasting, oranges.	[]
11) Hearing, the sound of escaping steam.	[]
12) The feeling in your body, kicking something away.	[]
13) Seeing, the sun rising above the horizon into a hazy sky.	[]
14) Hearing, the honk of an automobile.	[]
15) Feeling, fur.	[]
16) The feeling in your body, running upstairs.	[]
17) Hearing, the mewling of a cat.	[]
18) Seeing, the front of a shop to which you often go.	[]

- 1-Perfectly clear and as vivid as the actual experience
- 2-Very clear and comparable in vividness to the actual experience
- 3-Moderately clear and vivid
- 4-Not clear or vivid but recognizable
- 5-Vague and dim
- 6-So vague and dim as to be hardly discernible
- 7-No image present at all, you only "know" that your are thinking of the object

- 19) The feeling in your body, springing across a gutter. []
- 20) Hearing, the whistle of a locomotive. []
- 21) Tasting, jelly. []
- 22) Smelling, new leather. []
- 23) Seeing, a lake in the country. []
- 24) Tasting, salt. []
- 25) The sensation of, drowsiness. []
- 26) Feeling, the warmth of a tepid bath. []
- 27) Smelling, fresh paint. []
- 28) The sensation of, a sore throat. []
- 29) Tasting, granulated (white) sugar. []
- 30) Hearing, the clapping of hands in applause. []
- 31) Seeing the exact contours of face, head, shoulders and body of a relative or friend. []
- 32) Feeling, linen. []
- 33) The sensation of, fatigue []
- 34) The feeling in your body, drawing a circle on paper. []
- 35) Smelling, cooked cabbage. []

APPENDIX C

Headings on Autobiographical Recall Sheets

1. Preschool (before age 5) - Events
2. Preschool (before age 5) - Caregivers' Names
3. Preschool (before age 5) - Friends' Names
4. Primary School (age 5-12) - Events
5. Primary School (age 5-12) - Teachers' Names
6. Primary School (age 5-12) - Friends' Names
7. Secondary School (age 13-18) - Events
8. Secondary School (age 13-18) - Teachers' Names
9. Secondary School (age 13-18) - Friends' Names
10. Names of Vegetables
11. Adjectives

APPENDIX D

Script of Instructions

"Hello, my name is Chuck Huffman. I am conducting a study about memory. At this time, I will distribute a packet to each of you. Please do not open the packet or make any marks until I instruct you to do so. (Experimenter distributes packets). Does everyone have a pencil or pen? (Experimenter provides pencils to subjects who do not have one). Please read the first paragraph and sign your name if you agree to participate in this study. Do not proceed to the bottom of the page until instructed to do so. Is there anyone who does not wish to participate in the study? (Decliners are dismissed at this time). There are 4 questions on the bottom of the page 1. When you are finished answering them, please sit quietly until you receive further instructions.

Now, turn to page 2. I will read the instructions while you silently read along. (Experimenter reads instructions to the Bett's Questionnaire Upon Mental Imagery). Are there any questions? (Experimenter answers questions). When you finish answering the 35 questions place your pencil down, look up at me, and remain seated quietly. (Experimenter waits until all have finished before proceeding). During the next sequence, do not turn to the next page until I instruct you to do so.

Now, turn to page 5. At the top of the page you will see the words Preschool (before age 5) -- Events. When I say ""begin"", write down as many events as you can recall from this time period until I say ""stop."" ""Begin."" (Experimenter

simultaneously begins stopwatch and waits for 90 seconds to elapse) ""stop."" Now turn to page 6. At the top of the page you will see the words Preschool (before age 5) -- Caregiver's Names. When I say ""begin"", write down as many caregiver's names as you can recall from this time period until I say ""stop."" ""Begin."" (Experimenter simultaneously begins stopwatch and waits for 90 seconds to elapse) ""stop."" (This procedure continues until all time periods and categories have been administered. When the final treatment is completed, the experimenter will gather the packets).

Are there any questions? (The experimenter will answer any questions). Thank you for participating in this study."

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