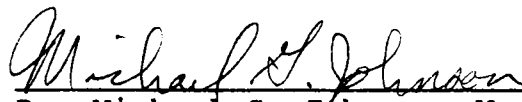


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REMEMBERING THE EVENTS OF A BASKETBALL SEASON:
AN AUTOBIOGRAPHICAL MEMORY STUDY

A Thesis

Presented for the

Master of Arts

Degree

The University of Tennessee, Knoxville

Jeffrey D. Jenkins

December 1994

DEDICATION

This thesis is dedicated to my parents

Mr. Wilburn D. (Butch) Jenkins

and

Mrs. Linda Jenkins

who have encouraged and supported my academic interests.

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ABSTRACT

This study used videotape to record the games of one team's intramural basketball season. The subjects were asked to recall specific events within the three games using a multiple, progressive cueing technique developed by the experimenter. Four variables were investigated, and each play that the subjects attempted to recall was coded according to its relation to the four variables. The four variables were retention interval, level of participation, frequency of action, and consequences of results. Each recall was given a score and categorized based on its accuracy and quality. Analysis involved comparing the memory scores and percentages of recalls associated with the different levels of the four variables.

There were three retention intervals, five week, four week, and three week intervals. There was little evidence to suggest that the retention interval affected the memory of different plays. Level of participation reflected how involved the subject was in each play. Personal plays were ones in which the subject was the central player and were recalled more completely and with more detail than Connected (plays in which the subject was minimally involved) and Observed (plays in which the subject was not involved) plays. Frequency of action referred to how frequent the actions in the play to be recalled was in a game. There was a difference observed between Single (plays with actions that only occurred

once) and Several (plays with actions that occurred more than five times) with respect to the percentage of plays not recalled; Single plays were less likely to score zero than Several plays. Finally, plays that were positive or negative were examined. No differences were observed in memory for these types of plays.

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CHAPTER I

INTRODUCTION

Autobiographical memory refers to one's memory of his or her own life experiences. In the last fifteen to twenty years, there has been an increased interest in autobiographical memory on the part of cognitive psychologists. This recent interest in autobiographical memory is long overdue. Although such research may be found in the work of Sir Francis Galton and Sigmund Freud, there has been a long silence on the subject until the recent ecological movement in cognitive psychology (Neisser, 1978) with its emphasis on moving out of the laboratory and studying memory in natural contexts.

Despite the increasing numbers of studies of autobiographical memory that use different methods and attempt to answer different questions, there remain some limitations that cannot be ignored. By moving out of the laboratory, researchers lose control of the variables that influence autobiographical memory. Likewise, researchers have a difficult time collecting records of the events to be remembered in order to verify subjects' recollections, since they are recalling events from their own lives. The research reported here reflects an attempt to study autobiographical memory by collecting an objective record, using videotape, of real events in the lives of the subjects. In this way,

recollections can be checked against the record of the original event, and variables that have been suggested to influence the accuracy, quality, and forgetting of personal experiences can be examined. A basketball game (or any athletic contest) lends itself to videotaping and is an example of a real event in which people participate. Therefore, the events to be recalled were events within the games of a basketball season. This technique provides a way to verify the recollections and test the variables that have been found to affect the accuracy of autobiographical memory.

Review

The tradition from which the recent interest in autobiographical memory has arisen was initiated by Sir Francis Galton. Robinson (1986) discussed Galton's interest in autobiographical memory, as distinct from the memory research done by Freud and Ebbinghaus. Although all three were contemporaries and were interested in memory, Freud and Galton studied memories of personal experiences directly, while Ebbinghaus studied memory for meaningless material. Freud's and Galton's respective approaches to studying autobiographical memory differed. Freud was interested in reconstructing one's personal past in order to understand and treat neurosis. Galton was interested in discovering the content of personal memories for its own sake.

Galton devised two techniques for studying imagery and

memory. One was the breakfast questionnaire, which required subjects to recall the appearance of their breakfast table that morning. Galton found that children and women reported more vivid mental images of their breakfast table than scientists.

The other technique was the word association technique. Galton presented himself with a word and recorded the memories and associations that the word elicited. By using this method, Galton made some observations about the quality and organization of personal memories. He categorized the information that came to mind as either sensory images, words or names, or general impressions (Galton, 1883). He thought that he would be able to classify different words as to the type of memory they elicited. He also recorded his reaction time and observed the differences between memories from different periods of his life.

One conclusion that he drew was that there are not as many ideas or memories in the mind as he thought. This was based on the result that many of the same memories came to mind for different cue words or over separate trials. He also suggested that there are more complete and detailed memories of recent experiences. There were a variety of experiences that he recalled from recent times, but the same experiences came to mind when recalling something from the distant past. These conclusions express his interest in understanding how personal experiences are organized and what qualities do they

possess.

The researchers who have revived the interest in autobiographical memory share that goal and have tried to reach it using similar methods. Crovitz and Schiffman (1974) are cited by several authors as the researchers who initiated the recent interest in autobiographical memory. They modified Galton's word association technique in order to examine specific personal memories. Instead of reporting anything that came to mind, they asked their subjects to recall and report a specific event that related to the word presented. The recollections were analyzed according to the period of the subject's life in which they originally occurred. They found that fewer autobiographical memories were recalled from older time periods than from more recent time periods in the subjects' lives.

Other researchers used a similar cue word technique to study autobiographical memories. Robinson (1976) examined the age and latency of memories that were cued by different words. He found that response times were shorter when words associated with objects or actions were presented than when words associated with affect were presented. He also observed a curvilinear relationship between the age of the memory and the retrieval time. Middle-aged memories were retrieved more slowly. These results suggest that memories are organized around the object or action of the event rather than the affect. It also suggests that the time since an event may

affect the accessibility.

Like Robinson, Fitzgerald (1980; 1981) studied the latency of memory retrieval for different words over the life-span. He found that adolescents recalled memories as quickly using affect cues as to object and action cues. This suggests that the organization of autobiographical memory changes over different developmental stages.

Rubin (1982) also used the cue word technique. He asked subjects to recall specific memories related to the words presented and to date the memories. He also found that fewer memories could be recalled from long ago.

This was only the beginning of the ecological approach to studying memory. In 1978 the first Conference on the Practical Aspects of Memory was held (Gruneberg, Morris, and Sykes, 1978). The researchers who presented their work demonstrated that meaningful research can be done away from the laboratory. Ulric Neisser, who has been a leader in the ecological memory movement and in the study of autobiographical memory, opened the conference by discrediting the memory research done in the laboratory over the past one hundred years (Neisser, 1978). He urged memory researchers to begin studying what people really remember where they remember it. Neisser and many other researchers have certainly worked hard to answer some interesting questions about memory in the real world. The study of autobiographical memory has been one area that has grown out of this movement.

Although the study of autobiographical memory has become popular, there are some problems that researchers encounter when they leave the friendly confines of the laboratory. Mainly, they lose some control of the variables that may influence memory. Much of the time researchers ask their subjects to self rate certain variables of interest. Another problem is having an independent, objective record of the material that is remembered. In each of the studies mentioned above, there was no effort made to verify the recollections of the subjects. Using the cue word technique, researchers can obtain recollections of past experiences, but they do not know how complete or incomplete, nor how accurate or inaccurate the memories are. Without being able to assess the contents of the memory as compared to the original event, the conclusions that can be drawn are limited. An example of how important it is to have an original record of the recalled events can be found in the research on flashbulb memories.

Brown and Kulik (1977) contributed a famous and controversial paper about a special kind of autobiographical memory, called flashbulb memory. They contended certain highly surprising and consequential events are remembered as if we had taken a picture of it. The classic example is that of recalling when one first heard of President Kennedy's assassination. They observed that many people claimed to have extra-vivid memories of hearing the news, and they wished to study this phenomenon.

They had white and black subjects recall the events that occurred when they first heard the news of ten possible flashbulb events. The events included assassinations, attempted assassinations, and shootings of different white and black leaders. They also had the subjects rate how frequent they rehearsed the event and how consequential the event was.

They found significant differences between whites and blacks on three different events. Blacks were much more likely than white subjects to have a flashbulb memory of the assassination of Martin Luther King, Malcolm X, and the shooting of George Wallace. Since each of these men were involved in one way or another in civil rights issues, they were more consequential to black individuals. As expected by Brown and Kulik, they produced flashbulb memories. They also found significant correlations between consequentiality ratings and the number of content units present in the free recall accounts. This seemed to support the idea that consequentiality affects memory.

They used this evidence to suggest the special "Now Print" mechanism for consequential or surprising events. The Brown and Kulik paper has sparked much research and criticism. In fact, a whole book contained a collection of articles that responded to Brown and Kulik's contention that flashbulb memories occur and are controlled by a "Now Print" mechanism (Winograd and Neisser, 1990). Evidence presented in some of this research does not support the notion of flashbulb memory

and the existence of a "Now Print" mechanism is in question.

In one paper, Neisser and Harsch (1990) presented data that questions the veridicality of so-called flashbulb memories. Neisser and Harsch asked subjects to record how they received the news of the space shuttle Challenger accident the day after it happened. Three years later the subjects were asked to recall again the occasion in which they heard of the shuttle accident. They found that 25% of the subjects were completely wrong about the occasion. Only three out of forty-four subjects obtained a perfect score on their scoring system, which awarded points for each accurately recalled detail. At the time of the second recall, they had the subjects rate how confident they were in their memory. A very high percentage of the subjects rated their confidence very high and had scored very low on accuracy. This evidence calls in question the notion of flashbulb memories. These findings suggest that our memory of personal experiences, even highly surprising and consequential events, may not be as good as we think.

Brown and Kulik had hypothesized a special memory mechanism for consequential and surprising events. They based it on recollections which they could not compare with the original event. If they had records of the original event or the "flashbulb memories" soon after the event, like Neisser and Harsch, they would probably found the same deficiencies that Neisser and Harsch found. It serves as a good example

that theories about how memory works without being able to verify the memories can be erroneous. Researchers have attempted to correct that problem by employing new methods of studying autobiographical memory. Likewise, this study uses a new method to collect an original record of the events to-be-remembered.

Neisser (1981) did a case study on John Dean's memory by comparing his testimony with the transcripts of the tape recorded events that he was questioned about. After carefully comparing Dean's testimony of the events on two separate occasions with the recordings, Neisser discussed how memories can be true but not necessarily accurate. Dean's memory had been inaccurate about some specific details of the conversations. Nevertheless, the information he provided about what was generally happening in the conversations was right. Neisser concluded that his memory was filled with what he termed "repisodic" memories. They were not specific personal experiences or episodic memories that Tulving (1972) had described, but they were recalled as if they were. Dean was inaccurate in the sense that specific details of specific events were wrong but what he recalled seem to be true in the sense that it is what seemed to happen over repeated experiences. Therefore, repetition of similar events may affect the accuracy of memories, but it should not make them completely wrong.

Researchers are usually not so fortunate to have tape

recorded conversations to compare to testimonial recollections. Some have utilized diary collections as a way to record the events to-be-remembered. One well known diary study was conducted by Linton (1975; 1986). She recorded two events per day for six years on index cards. She periodically attempted free recall, recall based on a cue, and recognize events that had been recorded. She demonstrated that diaries could be used to study autobiographical memory. Her results revealed that there was not a very high rate of forgetting, that negative events tended to drop out of memory over the years, and that memory was better for those events that were chosen to be recalled or recognized more often.

Like Linton, Wagenaar (1986; 1988) recorded events from his life for six years. He recorded the "Who, What, When, and Where" of over 2,400 events. He then tested himself by using one or a combination of the elements of the event as a cue. He found that What information was the most effective. When was almost useless. He concluded that cue specificity determined whether the event was recalled (Wagenaar, 1988). What information was more specific. Who and Where information occurred frequently over many different events and did not indicate uniquely what event was in question. He also produced forgetting curves for events as a function of rated salience, emotional involvement, and pleasantness. Without a record of the events he could not have determined the rate of forgetting over time.

Linton and Wagenaar demonstrated that diaries could be useful in studying autobiographical memory, but each only involved one subject. One diary study was conducted that used six subjects and was aimed at testing how well the subjects could distinguish between events they had experienced and ones they had not (Barclay and Wellman, 1986). The subjects were instructed to record events each day in a diary. Their memory was tested by a recognition test that included some of the recorded events plus foil items that had been developed by the researchers. They included some foils that differed with respect to the action that occurred, some with respect to the emotional response or evaluation of the event, and some were events that another subject had recorded. The rate of correct recognition was high but the false alarm rate was high as well.

In a follow-up study, Barclay and DeCooke (1988) had independent raters rate the foils on the semantic similarity to the original detail. Those foils that had been accepted as personally experienced events were high in semantic similarity. Barclay attributes this kind of performance to the schematization of repeated personal experiences (Barclay, 1986). He echoes what Neisser had said about memories being true but inaccurate. Based on one's schematized self-knowledge, one may misremember a specific detail, but it will be consistent with what one knows about oneself.

One problem with this kind of diary study is that

subjects were writing down the more memorable events to begin with. By recording the more memorable events, recall or recognition performance is going to be better than recall of mundane events. Brewer (1988a) attempted to remedy this problem by having subjects carry beepers during everyday activities for about two and a half weeks. They were alerted at random intervals, at which time they would record what they were doing, what they were thinking, and rate the event and their experience on several rating scales. The characteristics were rated on seven-point scales which included action frequency, pleasantness, significance, excitedness, goal-directedness, overall memory, and phenomenal experience for each sense. He conducted both recognition tests and cued recall tests for the recorded events.

On the recognition test subjects were required to rate on a seven-point scale how well they recognized the event that was described to them. His results demonstrated that the rate of forgetting for randomly sampled events was greater than forgetting of events that were recorded each day that were considered memorable events. The event characteristics that were found to affect recognition memory of actions were frequency of that class of action, the significance of the event, and the excitement that accompanied the event. Infrequent, significant, and exciting events were recognized better. Recognition memory for thoughts were rated as more pleasant, significant, and exciting. He concluded that on the

whole, infrequent actions are remembered well and exciting thoughts are remembered well.

The recalls collected from the cued recall test were qualitatively analyzed into seven recall types (Brewer, 1988a). Events that were not recalled were Omits. Recalls that were obviously a different thought or event than was on the record were classified as Wrong Events. A Wrong Time Slice was a recall that was slightly offset in time from the event that was recorded. An Overt Error was one in which there was a contradiction between the recall and the record. An Inference was one in which the subjects appeared to recall the event based on knowledge of their life. A Correct Recall was one that contained correct information that could not be inferred. Finally, a Correct with Detail recall was one that was correct but included some irrelevant detail that was not recorded at the time of the event. The ratings of the several event characteristics were then examined as to how they related to the different recall types.

The results of the cued recall test revealed again that the frequency of the action affects memory. Those recalls that were scored as Correct were rated as less frequent than those recalls scored as Omits. The location frequency was rated lower for Correct recalls than for Omits or Overt Errors. The largest differences between the ratings for Correct and Omit recalls for thoughts were on the location frequency, excited, action frequency, and goal-directedness.

Brewer also noted that the phenomenal experience scales, especially visual phenomenal experience, was rated higher for Correct and Correct with Detail recalls than for Omits, Errors, and Inferences. The Overall Memory ratings that the subjects gave for each recall seemed to correspond well with their performance.

From this very extensive research of memory for randomly sampled events, Brewer drew several conclusions. Events recorded each day because they are considered memorable are recognized better than the random events recorded after being alarmed. The randomly selected events for recall are forgotten more frequently than those in previous diary studies. The variables that show most consistent relationship with good memory performance are rare actions and rare locations. There are differences in memory performance for thoughts and actions. Exciting thoughts seem to be remembered better. High ratings on phenomenal experience scales are associated with high confidence ratings and recalls that are accurate and contain detail. These findings support Brewer's contention that a partial reconstructive theory (Brewer, 1986) reflects how autobiographical memory operates.

Theory

Much of the research on autobiographical memory has indicated how erroneous memory for personal experience can be. The John Dean memory study, the research on remembering the

Challenger accident, and Barclay's research demonstrating how subjects easily accept experiences as their own, even when they are not, all indicate that personal experiences are not encoded like information from a floppy disk, captured like a photograph, or recorded by some kind of video camera in the head. Based on these findings, many think that autobiographical memory is a process by which experiences are reconstructed, rather than recalled directly. Experiences are somehow altered during encoding and the details are reconstructed and inferred from the various knowledge representations in the mind.

An example of a model which purports to explain how autobiographical memories are reconstructed is the context-plus-index model (Reiser, Black, and Abelson, 1985; Reiser, Black, and Kalamarides, 1986). According to this model when asked about a particular experience, one will first access information that will indicate in what context this could have happened. For example, a college student is asked when he last talked to a particular friend. The student will first think of all the possible contexts in which they could have met. Possibly, he would access information about "Going to bars." From the context the student would then utilize strategies to access the details that distinguish it from other experiences. It is by this retrieval process that one searches through very complex and rich knowledge structures of events and experiences that the experience in question is

reconstructed. According to this kind of model, there are no experiences that have been coded directly as they were experienced. Brewer (1986; 1988b) disagrees with this kind of strong reconstructive theory and has hypothesized a partial reconstructive theory based on his research.

Brewer contends that some experiences are stored and recalled as very nearly a copy of the experience. Recent experiences maintain a large amount of the detail and original phenomenal quality of the actual event. But, over time or under strong schema-based processes, the personal memory can become reconstructed into a nonveridical memory. His own research demonstrated that Correct or Correct with Detail recalls tended to be of infrequent activities and locations (Brewer, 1988a; 1988b). It is the repetition of activities that produce reconstructed memories. Brewer, unlike the strong reconstructionists, says that experiences can be veridical, true, and nearly relived recently after encoding. It is after repeated experiences and time that it becomes altered and is recalled with errors and distortions.

Purpose

The purpose of this research is twofold. First, a new method is used to study autobiographical memory. Second, some of the variables which have been found to influence the memorability of personal experiences can be examined as they exist in some real life events.

As the literature review reveals, researchers have attempted to find better ways to record events that will be recalled later, but there are some problems with the methods that have been employed. This study used video recordings to capture the events to be recalled. By using video tape, the subjects were not required to make any special effort to record the events, like in a diary study or when randomly signalled to record the event. They did not get to freeze the event momentarily by writing it down. The subjects just behaved naturally, and the event was recorded by the video camera.

Obviously, it is inconvenient to videotape many activities that people experience. One activity that is easy to videotape and is done frequently is basketball. Basketball is a complex event that individuals participate in naturally and is an interesting setting to examine how personal experiences are remembered.

Another advantage of using video tape to record the basketball events was that the variables in question could be observed and coded by the researcher. In several of the studies discussed earlier the subjects were required to rate the variables that were being examined. With a video tape of the events the subjects did not have to rate the event with respect to different variables. The researcher observed for himself how each event relates to the variables in question. In this study four variables were examined.

The four variables were examined by answering the following research questions: 1) Do autobiographical memories fade over time? The retention interval for personal experiences may affect how and in what form these experiences are stored in memory. 2) Are events in which one is the central participant remembered better than events in which one is less involved? An event in which one is the main character is more important to that individual and may be remembered more completely. 3) Are events that involve infrequent actions recalled better than events involving frequent actions? Novel or unusual events seem to be remembered better in other studies. 4) Are positive or negative events remembered better?

Several of the studies reviewed above have observed how autobiographical memories are changed or forgotten over time. Forgetting seems to occur slowly (Linton, 1975) but over time increases (Crovitz and Schiffman, 1974; Rubin, 1982). Brewer even reported that there were not very many randomly selected events forgotten completely. According to Brewer's partial reconstructive view, recent experiences are nearly relived when recalled. By recording all three games in the intramural season, there were three retention intervals, which provided a way to examine how memories changed or were forgotten over time. Based on previous research, it was expected that events from more recent games would be remembered more completely and accurately.

The research question dealing with the participation of the subject in the play is aimed at examining the personal importance variable that has been found to affect the vividness of a memory. Rubin and Kozin (1984) found that subjects who were instructed to recall their three most vivid memories and rate them on different characteristics rated the experiences as very high in personal importance. In this study personal importance of a particular play will be observed by the level of participation of the subject. It is expected that plays in which the subject is a central participant will be remembered better.

Repeated experiences seem to have an adverse effect on the quality of a personal memory. Neisser's discussion of repisodic memory emphasizes the effect of repetition (Neisser, 1981). Brewer found that events that were recalled correctly and were associated with high confidence ratings and high visual imagery ratings were those that occurred infrequently and in unique locations. Based on this it is expected that plays that involve actions that are infrequent will be remembered better.

The final variable has to do with remembering positive and negative plays. Linton (1975) observed that negative events seemed to disappear from her memory over time. It would be expected that the positive plays will be remembered better. One difference in this study is that the retention interval is shorter. The negative events may not have time to

be forgotten. Also, in sports it is important to remember mistakes in order to improve performance. It may be that negative events may be remembered as well or better than positive events.

CHAPTER II

METHOD

Subjects

The subjects for this study were members of an intramural basketball team at the University of Tennessee, Knoxville. The team consisted of students from a fraternity on campus. They were selected after responding by mail as willing to participate in the study about their team. Contact information was provided by the intramural office which included names and phone numbers of representatives of residence hall, fraternity, and sorority teams that consistently participated in intramural sports. Ten of these individuals were contacted by phone and asked if their team might be willing to participate in "a study about what happens during their intramural basketball season." Eight of those ten reported that they would be willing to participate. Only two teams responded by mail after receiving a description of the study and a request to send back some information about their team if they were willing to participate. Of the two teams that responded, the fraternity team was selected instead of a residence hall team, because of the convenience of contacting someone about game times and scheduling interviews with the subjects at the end of the season. Ten players out of fourteen that played at least one game were able to be scheduled for interviews in which they attempted to recall events from their games. All of the ten subjects were of traditional college

age, between eighteen and twenty-two.

Procedure

The subjects participated in their regularly scheduled intramural basketball games and later were asked to recall some specific events that occurred during those games. The three games in which the team participated were video-recorded. Before the first game, informed consent was obtained. They were told that the experimenter would record their games and there would be an interview scheduled with each player concerning things that happen in the games. There was no other contact between the subjects and the experimenter, except to periodically verify game time and location with the team captain. The experimenter recorded the three games without providing a way for the subjects to know what would be asked about the games during the interview.

After the season, interviews were conducted with as many subjects as possible. Ten subjects were able to be scheduled for an interview. The interview consisted of a cued recall task. Each subject was asked to recall ten plays from each game according to a cued recall protocol that is described below. Recalls of the games were obtained in chronological order. The ten plays from the first game played were recalled first, followed by the ten plays from the second game and so on. The interviews were conducted three weeks after the last game played. This produced retention intervals of five weeks

for game one, four weeks for game two, and three weeks for game three.

Play Selection

The experimenter examined the videos of each of the three games played and selected a number of plays from each game that involved different players, were unusual or unique, and were easily describable. The plays that were selected involved different players on the subject team. Some of the plays were selected because they were unique, such as a backcourt violation or a technical foul. Most of the plays could be described by a typical statistic that is kept for basketball games, such as scoring, blocked shots, and fouls. Most of the plays were offensive plays. The ones that were defensive were usually fouls. This was done to ensure that there was someone on the subject team that was actively involved in the play. There were a few other plays that were selected because they seemed to be typical for the team. For example, a play involving a missed lay up may have been selected because the team had missed so many shots during that period. The plays were selected primarily based on the experimenter's judgement that the play could be remembered, was describable, and was observable on the videotape.

Based on these criteria, twenty plays were selected from game one, twenty-four from game two, and eighteen from game three. Ten were randomly selected from each game to be

recalled.

Cue Protocol

The ten plays from each game were recalled according to a cue protocol developed by the experimenter. It consisted of three levels of information that would be used to cue the subjects' memories. The first level would be given followed by a recall attempt. If the subject could not recall the event, the second level was given. If the second level did not cue memory of the play, the third level was given. Each level of information used to cue recall contained more detail about the situation and actions that occurred during the play in question. This seems to be the way inquiries are made in the real world. Linton (1986) suggests that this type of method is more like what occurs naturally. One may proceed to help someone remember an event by saying, "Do you remember when...." "No." "Oh, you remember there were..... and.....and you....." This multiple cue technique was adopted for this reason.

This specific technique has not been used in the study of autobiographical memory. Barclay and Wellman (1986) presented all the information recorded for a single event to subjects for recognition. Brewer (1988) presented a single cue to each subject consisting of information about either time, location, thought, or activity. Wagenaar (1988) presented himself with single cues and double cues. First, he would cue his memory

with either Who, What, When, or Where information. Next, he presented himself with combinations of each cue type. Neisser and Harsch (1990) did use a technique similar to the one used in this study. To help subjects recall when they heard of the Challenger accident, they asked questions about the events leading up to the occasion, their reaction to the event, and what they did after they heard of the event. This is similar in that it does attempt to trigger memories that may be connected to the target event. The technique used in this study actually presents more specific information to the subject, instead of questioning the subject about connected events. As mentioned above, the reason for this is that it seems that in everyday activity, individuals help others to recall an event by asking them about the event generally then giving them more information about the event until the memory is retrieved or until the individual admits they have forgotten.

Specifically, each level contained the following information:

Level I consisted of Who (the central participant) and What happened in general terms. An example is, "B.J. lost the ball while shooting." Other examples of general What information are "got fouled", "made a three-point basket," or "committed a backcourt violation." It reveals nothing about the specific movements or actions of the player involved.

Level II consisted of What (peripheral action) was taking place in more specific terms, Who (peripheral participant), and Where the peripheral action took place. The focus of this cue is to indicate what events and actions led up to the target event and what actions were taking place around the target event. The second level of information given for the example used for level I is, "He received the ball from C.G. who was in the left corner (facing the goal)."

Level III consisted of very specific information about the play. It contained Where the target player and play took place and specifically What the target player did. The example is, "B.J. received the pass near the top of the key; as he jumped to shoot, the ball slipped out of his hands into the air and behind him." Level III essentially reveals all the important information about the play.

Subjects were instructed to recall the play in question, if the information cued their memory for that play, otherwise they responded "no" or "nothing". They were to recall the play as if the experimenter had never seen the play and they wanted him to understand what happened. During the course of the interview, the experimenter would ask some questions about details that may have been left out or was not clear. One detail that was requested after each recall attempt was Where the subject was. This detail could easily be observed on

video tape and could reveal something about the phenomenal quality, specifically mental imagery, of the memory. If a subject could recall accurately from what perspective he viewed the event, this would indicate to what extent the event is "relived" visually.

Coding

Each play that was recalled was coded according to the independent variables that were being examined. The four variables were time or retention interval, level of participation, action frequency, and consequences. In previous studies the subjects self-rated variables that were being examined (e.g. Brewer, 1988; Rubin and Kozin, 1984). In this study the four variables could be examined without asking the subjects to subjectively rate the variable. The experimenter could observe and code each play as to how it relates to each level of the four variables.

The retention interval was determined by which game the play occurred in. The interviews were conducted three weeks after the last game; therefore, there was a retention interval of three weeks, four weeks, and five weeks for plays from Game 3, Game 2 and Game 1, respectively.

Each play was also coded according to the level of participation of the subject attempting to recall the play. Three levels were coded. The Personal level was coded if the subject was the central character of the play. The play was

coded as Connected, if the subject was a peripheral participant of the play. An example of this type of play would be Subject X attempted to recall a play in which he passed the ball to the central character. The last level was Observed. This was coded if the subject was uninvolved in the play in question, either in the game or out.

The frequency of the action of the play being recalled was coded. The experimenter recorded the frequency of certain actions in each game, such as shots taken and made, blocked shots, fouls, and other normal basketball statistics. Each play was coded by frequency of occurrence. A play was coded as Single if it had only occurred once in the game. An example of this would be a technical foul. A play was coded Few if the action occurred two to five times during a game. Finally, a play was coded as Several if it occurred more than five times a game.

The final variable was related to the consequences of the play. Each was coded as positive or negative, depending on whether it aided the subject's team toward a goal or hindered them. Positive events were such things as scoring, getting fouled, and blocking a shot, and negative events were such things as fouling, missing a shot, or getting a shot blocked.

These four variables were examined with respect to how well the different plays were recalled. In order to do this a scoring system was developed to reflect the quality and accuracy of each recall.

Scoring

A four point scale was used to rate each recollection for quality and accuracy. In addition to scoring the recalls, each was analyzed according to the details that it included. The score given to each recall depended on what details were included and their accuracy.

The scoring scheme developed here is similar to the one used by Neisser and Harsch (1990) to score the accuracy of the recall protocols of when the subjects heard of the Challenger accident. They gave points based on the presence of details that were considered to be included in all flashbulb memories. The sum of the points awarded plus bonus points for additional detail was the score used given to each recall. Brewer (1988) also scored each recall on a three-point scale based on the accuracy of the recall. In this study, the details were the ones obtained in pilot data and the points awarded were based on the details included in the recall.

Pilot data revealed that several different details could be identified in recollections of basketball plays. They are as follows:

- (1) General actions of the central player,
- (2) specific parts of the central action.
- (3) General location of central activity.
- (4) Specific location of central activity.
- (5) General actions of peripheral players.
- (6) Specific actions of peripheral players.
- (7) Identification of peripheral player.
- (8) Where peripheral

action occurs. (9) Location of subject. (10) When play occurred. (11) Other--information that may have been included that could not be verified, such as thoughts or emotions.

Each part of every recall was scored using these detail types. Whether the detail was accurate or not was noted. The score given for the recall was dependent upon which details were included and if they were accurate based on what was observed on videotape.

The four scores that were given to reflect the quality of the memory and its accuracy are defined as follows:

0--(a) there was no recall of the play at all, (b) the play recalled was obviously the wrong play, or (c) the only thing recalled was some peripheral detail without any recollection of the central activity of the play.

1--there was no specific detail included and there was inaccurate information in the recall.

2--the play was (a) recalled accurately but was general or (b) included specific detail but also included at least one inaccurate detail.

3--the recall had no inaccurate information, included specific detail, and represented well what happened.

Each recall was then given bonus points according to the amount of cueing presented before recall. For each recall requiring only one level of cueing, two (2) bonus points were added. For each recall needing two levels of cueing, one (1)

bonus point was added. No points were added for recollections that needed all three levels of cueing. Using this method, each recall collected was given a "Memory Score" between 0 and 5.

Analysis

Mean memory scores for each subject and the percentages of recalls in three Memory Quality categories under each level of the four variables were dependent measures. The mean memory score was used due to the varying number of plays that each subject recalled under each level of the four variables.

The Memory Quality categories were used in order to examine more closely each condition and the kinds of memories that result from that condition.

The Memory Quality categories are defined as follows: First, the "Complete/Detailed" category included those recalls that had a Memory Score of 4 or 5. Second, the "Incomplete/Inaccurate" category included recalls that had been scored 1, 2, or 3. Third, the "No recall" category was those scored 0.

Comparisons were made between the percentages of recollections in each Memory Quality category for each variable.

Because of the small number of subjects, nonparametric statistics were used. Pairwise comparisons were conducted for each variable using the Sign Test and the Wilcoxon Signed-Ranks Test. Comparisons were made between two levels of each

variable at a time, because with some of the variables very few subjects had scores for all three levels. By comparing two at a time, all the possible pairs in the two groups would increase the number of scores available for comparison. Therefore, for each variable, comparisons were made between two levels of each variable at a time, first for the mean memory scores, then for the percentages of each memory quality category.

CHAPTER III

RESULTS

Sign Tests and the Wilcoxon Signed-Ranks Tests were conducted for each pair of levels under each variable. Sign Tests were computed first. The Sign Test requires that the number of differences in the opposite direction (x) than was hypothesized be observed, and an exact probability, based on the binomial probability function is obtained for that number according to the number of pairs being compared (N). The results of the Sign Test are reported first. Because of the small sample size, the Sign Test probabilities are more useful as descriptive rather than inferential statistical measures.

First, the mean memory scores were compared among all possible pairs of levels under each variable. Retention Interval was considered first. The hypothesis was that shorter retention intervals will be associated with higher memory scores. Three of five subjects' scores increased between the 5 week and 4 week interval which produces a $p=.50$. Between the 4 week and 3 week interval, one difference out of six subjects was in the opposite direction than predicted, which produces a $p=.109$. The number of subjects that were in both the 5 week and 3 week intervals was three, therefore a comparison could not be done.

It was expected that Personal plays (those in which the subject was the central participant) would be recalled better

than Connected plays (those in which the subject was a peripheral participant), which would be remembered better than Observed plays (those in which the subject was uninvolved). For level of participation, the sign test produced the following probabilities: Between Personal and Connected, $N=8$, $x=2$, $p=.145$. Between Connected and Observed, $N=9$, $x=4$, $p=.50$. Between Personal and Observed, $N=9$, $x=1$, $p=.02$. The Personal level was observed to be recalled better than the other two levels.

It was hypothesized that memory performance would vary with frequency of action; Single plays (those that included actions that occurred once) would be remembered better than Few plays (those that included actions that happened two to five times) which would be remembered better than Several plays (those that included actions that occurred more than five times a game). For frequency of action the following results were obtained: Between Single and Few, $N=10$, $x=4$, $p=.377$. Between Few and Several, $N=8$, $x=3$, $p=.363$. Between Single and Several, $N=10$, $x=3$, $p=.172$. The lower probability obtained between Single and Several plays is evidence that the two types of events may be remembered differently.

Finally, for positive and negative, plays 5 of 9 subjects had a mean memory score higher for positive plays. This produced a $p=.50$ ($N=9$, $x=4$).

The percentages of "Complete/Detailed" recalls were analyzed next. The hypothesis for retention interval was that

the percentages would decrease with longer retention interval. The Sign Test revealed the following results: Between the 5 week and 4 week intervals, $N=5$, $x=2$, $p=.50$. Between the 4 week and 3 week intervals, $N=5$, $x=1$, $p=.188$. Too few subjects were included under both the 5 week and 3 week intervals. The probability that there would be only one difference opposite that expected was less than 20%. This suggests that more recent experiences are remembered better.

The differences in percentages of "Complete/Detailed" recalls for level of participation produced the following probabilities: 6 of 8 observations were greater for Personal than for Connected, which produces a $p=.145$. Between Connected and Observed, 6 of 9 observations were in the predicted direction (Connected > Observed), which produces $p=.254$. The Personal and Observed comparison revealed that 7 of 9 differences were in the predicted direction (Personal > Observed), which produces a $p=.09$. As was predicted, the Personal level seems to be remembered better than the other levels. The difference between Personal and Observed is especially noticeable.

Analysis of the percentages of "Complete/Detailed" recalls revealed the following results: Between Single and Few levels, $N=10$, $x=4$, $p=.377$. Between Few and Several, $N=8$, $x=4$, $p=.50$. Between Single and Several, $N=8$, $x=3$, $p=.363$. The hypothesis is that Single is greater than Connected which is greater than Observed. These probabilities are not low

enough to suspect that the different levels are remembered differently.

Finally, percentages of Complete/Detailed recalls for positive and negative plays were analyzed using the Sign Test. Six of the ten differences were in the predicted direction (positive > negative), which produces a $p=.377$.

Next, the percentages of "Incomplete/Inaccurate" recalls were analyzed using the Sign Test. No comparisons could be made for the retention intervals, because there were too few differences in the percentages for each pair of levels.

The Sign Test on percentages of "Incomplete/Inaccurate" recalls for level of participation reveals the following results: The hypothesis is that there would be a lower percentage of "Incomplete/Inaccurate" recalls for Personal than for Connected, which would have a lower percentage than Observed. Between the Personal and Connected levels, $N=5$, $x=1$, $p=.188$. Between Connected and Observed, $N=9$, $x=3$, $p=.254$. Between Personal and Observed, $N=9$, $x=2$, $p=.09$. Again the Personal plays seem to be associated with better memory.

The Sign Test using "Incomplete/Inaccurate" recalls for frequency of action revealed the following: Five of ten differences between Single and Few were in the predicted direction (Single < Few), which produces a $p=.623$. Between Few and Several, $N=9$, $x=3$, $p=.254$. Between Single and Several, 5 of 10 differences were in the predicted direction (Single < Several), which produces $p=.623$. None of these

probabilities are low enough to suspect a difference in memory of plays with varying action frequencies.

The Sign Test for positive and negative events revealed that 6 of 9 differences were in the predicted direction (positive < negative). The probability of this is .254 . Again, no difference was observed.

Finally, the Sign Test was utilized to analyze the "No Memory" recalls (forgetting) for each variable. The analysis of retention intervals could only be conducted between the 5 week and 4 week intervals. Four of the five differences were in the predicted direction (5 week < 4 week), which produces a $p=.188$. The probability that the percentages would change in the predicted direction is low enough to indicate that there is less forgetting of more recent events. The other two pairs could not be compared because too few subjects were in both levels of each pair.

Sign Test analysis of "No Memory" recalls for level of participation revealed the following: Between Personal and Connected, $N=7$, $x=3$, $p=.50$. Between Connected and Observed, $N=9$, $x=4$, $p=.50$. Between Personal and Observed, $N=8$, $x=2$, $p=.145$. The probabilities obtained here are not as low as in the other analyses for levels of participation. There is still some evidence that Personal and Observed plays are forgotten at different rates.

The Sign Test analysis of "No Memory" recalls for frequency of action revealed the following: Between Single

and Few, $N=9$, $x=2$, $p=.09$. Between Few and Several, $N=9$, $x=3$, $p=.254$. Between Single and Several, $N=10$, $x=2$, $p=.055$. Unlike the other analyses of action frequency, it is evident that there are differences in forgetting of Single plays from Few and Several plays.

For positive and negative events, there were 7 of the 10 differences in the predicted direction (positive < negative). This produced a $p=.172$. This probability is lower than the others between positive and negative plays. It may suggest that positive plays are not forgotten at the same rate as negative ones.

The Wilcoxon test was conducted after observing that many of the differences that were not in the predicted direction were usually very small. Since the Wilcoxon test involves magnitude of difference, it was expected that more significant differences would be observed than with the Sign Test, which only considers the direction of difference.

Table I contains the mean memory scores for each subject under each retention interval and the differences and signed ranks used in the Wilcoxon test. There was no significant differences in mean memory scores between the 5 week and 4 week intervals ($N=5$, $T=3$, n.s.) nor between the 4 week and 3 week interval ($N=6$, $T=6$, n.s.). There were too few subjects with scores under both the 5 week and 3 week intervals to compare the scores between them.

Table II contains the Wilcoxon test of mean memory scores

Table I: Mean Memory Score, Differences, and Signed Ranks of Differences for Wilcoxon Test of Retention Intervals.

Subj.#	5 wks	4 wks	3 wks	Diff/Rank (4wk-5wk)	Diff/Rank (3wk-4wk)	Diff/Rank (3wk-5wk)
1	1.40	1.10	1.70	-0.30/-1	0.60/ 4.5	0.30/ 1
2	0.70	2.30	--	1.80/ 5	--	--
3	--	2.20	--	--	--	--
4	--	1.80	--	--	--	--
5	1.00	2.00	2.30	1.00/ 4	0.30/ 2	1.30/ 2
6	0.80	1.70	2.20	0.90/ 3	0.50/ 3	1.40/ 3
7	2.20	1.70	--	-0.50/-2	--	--
8	--	1.80	1.00	--	-0.80/-6	--
9	--	0.40	0.60	--	0.20/ 1	--
10	--	1.60	2.20	--	0.60/ 4.5	--
				T=3, n.s.	T=6, n.s.	--

Table II: Mean Memory Score, Differences, and Signed Ranks
for Wilcoxon Test for Level of Participation.

Subj.	Pers	Conn	Obser	Diff/Rank (Pers-Conn)	Diff/Rank (Conn-Obs)	Diff/Rank (Pers-Obs)
1	3.25	4.50	0.83	-1.25/-1.5	3.67/ 9	2.92/ 8
2	4.75	0.50	0.71	4.25/ 7	-0.21/-2	4.04/ 9
3	4.00	0.00	2.25	4.00/ 6	2.25/ 8	1.75/ 4
4	2.00	--	1.40	--	--	0.60/ 2
5	4.50	0.00	1.76	4.50/ 8	-1.76/-7	2.74/ 6
6	0.00	1.75	1.60	-1.75/-4	0.15/ 1	-1.60/-3
7	2.25	1.00	2.13	1.25/ 1.5	-1.13/ 5	0.12/ 1
8	4.00	2.50	1.12	1.50/ 3	1.38/ 6	2.88/ 7
9	--	2.50	1.12	--	-0.53/-4	--
10	4.00	2.00	1.78	2.00/ 5	0.22/ 3	2.22/ 5
				T=5.5, p<.05 T=13, n.s. T=3, p<.01		

for the levels of participation. The Personal level was significantly greater than the Connected ($N=8$, $T=5.5$, $p<.05$) and the Observed ($N=9$, $T=3$, $p<.01$) levels. There was no significant difference between Connected and Observed ($N=9$, $T=13$, n.s.) mean memory scores. The Personal plays were remembered better than Connected and Observed plays.

The analysis of mean memory scores for frequency of action is presented in Table III. No differences were observed between Single and Few levels ($N=10$, $T=15.5$, n.s.) nor between Few and Several levels ($N=8$, $T=16$, n.s.) There was a significant difference in mean memory scores between Single and Several ($N=10$, $T=11$, $p<.05$). Those plays that included one-time occurrences were more likely to be remembered than the play that included actions that happened frequently.

The mean memory scores for positive and negative plays were analyzed as well. There was no difference in mean memory scores between positive and negative plays as Table IV demonstrates.

As with the mean memory scores, the Wilcoxon test was used to analyze the percentages of "Complete/Detailed" recalls for each level of the four variables. Table V contains the percentages of Complete/Detailed recalls for each retention interval. No difference was observed between the 5 week and 4 week intervals ($N=5$, $T=3.5$, n.s.) nor between the 4 week and 3 week intervals ($N=5$, $T=4.5$, n.s.). Again, only three

Table IV: Mean Memory Score, Differences, and Signed Ranks
for Wicoxon Test of Positive and Negative Plays.

Subj.	Positive	Negative	Diff/Signed Rank
1	1.00	1.60	-0.60/ -5
2	1.50	1.50	0/ --
3	3.00	1.86	1.14/ 8
4	1.67	1.86	-0.19/ -1
5	2.60	1.35	1.25/ 9
6	1.10	1.80	-0.70/ -6
7	2.50	2.00	0.50/ 4
8	1.71	1.23	0.48/ 3
9	0.71	0.38	0.33/ 2
10	1.43	2.15	-0.72/ -7
			T=19, n.s.

Table V: Percentages of Complete/Detailed Recalls, Differences, and Signed Ranks of Wilcoxon Test for Retention Interval.

Subj.	5 wks	4 wks	3 wks	Diff/Rank (4wk-5wk)	Diff/Rank (3wk-4wk)	Diff/Rank (3wk-5wk)
1	30	20	30	-10/ -1	10/ 1.5	0/ --
2	10	40	--	30/ 4.5	--	--
3	--	30	--	--	--	--
4	--	30	--	--	--	--
5	10	40	40	30/ 4.5	0/ --	30/ 1
6	0	20	40	20/ 2.5	20/ 3	-40/ -2
7	40	20	--	-20/-2.5	--	--
8	--	40	10	--	-30/ 4.5	--
9	--	0	10	--	10/ 1.5	--
10	--	10	40	--	30/ 4.5	--
				T=3.5, n.s.	T=4.5, n.s.	--

level of participation is in Table VI. As with the mean memory scores, significant differences were observed between subjects who recalled plays from both the 5 week and 3 week intervals, therefore no comparison was made.

The percentages of "Complete/Detailed" recalls for each Personal and Connected ($N=8$, $T=5$, $p<.05$) and between Personal and Observed levels ($N=9$, $T=3$, $p<.01$). No difference was observed between Connected and Observed levels ($N=9$, $T=17.5$, n.s.). Again, Personal plays seem to be remembered more completely and accurately than Connected or Observed plays.

Table VII contains the analysis of percentages of "Complete/Detailed" recalls for frequency of action. There were no significant differences between any two levels. Likewise, no difference was observed between positive and negative plays, as Table VIII demonstrates.

Next, analysis of percentages of "Incomplete/Inaccurate" recalls for each variable was conducted. For retention interval, no analysis occurred due to the small number of scores that differed in each pair of levels. Table IX contains the data for each retention interval.

Analysis of the percentages of "Incomplete/Inaccurate" recalls for level of participation is in Table X. No differences were observed between Personal and Connected ($N=5$, $T=1.5$, n.s.) nor between Connected and Observed ($N=9$, $T=23$, n.s.). There was a significant difference between Personal and Observed levels ($N=9$, $T=4.5$, $p<.025$). Personal plays are

Table VI: Percentages of Complete/Detailed Recalls, Differences, and Signed Ranks for Wilcoxon Test of Level of Participation.

Subj.	Pers	Conn	Obser	Diff/Rank (Per-Conn)	Diff/Rank (Conn-Obs)	Diff/Rank (Per-Obs)
1	50	100	17	-50/-3.5	83/ 9	33/ 4
2	100	0	7	100/ 6.5	-07/ 3	93/ 9
3	100	0	25	100/ 6.5	-25/ -5	75/ 6
4	50	--	20	--	--	30/ 3
5	100	0	28	100/ 6.5	-28/ -6	72/ 5
6	0	25	20	-25/-1.5	05/ 1.5	-20/ -2
7	25	0	36	25/ 1.5	-36/ -8	-11/ -1
8	100	50	18	50/ 3.5	32/ 7	82/ 8
9	--	0	5	--	-05/-1.5	--
10	100	0	22	100/ 6.5	-22/ -4	78/ 7

T=5, p<.05 T=17.5, n.s. T=3, p<.01

Table VII: Percentages of Complete/Detailed Recalls, Differences, and Signed Ranks for Wilcoxon Test of Frequency of Action.

Subj.	Single	Few	Several	Diff/Rank (Sing-Few)	Diff/Rank (Few-Sev)	Diff/Rank (Sing-Sev)
1	67	17	17	50/ 9	0/ --	50/ 6.5
2	0	25	22	-25/ -6	03/ 1	-22/ -3
3	100	25	25	75/ 10	0/ --	75/ 8
4	0	20	50	-20/ -5	-30/ -6	-50/-6.5
5	33	42	17	-09/ -3	25/ 7	16/ 2
6	50	8	17	42/ 8	-11/-5.5	33/ 4
7	33	25	33	06/ 2	-08/-3.5	0/ --
8	25	22	29	03/ 1	-07/ -2	-04/ -1
9	0	11	0	-11/ -1	11/ 5.5	0/ --
10	50	22	14	28/ 7	08/ 3.5	36/ 5
				T=18,n.s.	T=17,n.s.	T=7.5,n.s.

Table VIII: Percentages of Complete/Detailed Recalls, Differences, and Signed Ranks for Wilcoxon Test of Positive and Negative Plays.

Subj.	Positive	Negative	Diff/Signed Rank
1	20	30	10/ 3
2	17	29	12/ 4
3	67	14	-53/-10
4	33	29	-04/ -1
5	50	20	-30/ -9
6	10	25	15/ 6
7	50	21	-29/ -8
8	29	23	-06/ -2
9	14	0	-14/ -5
10	14	31	17/ 7
			T=20, n.s.

Table IX: Percentages of Incomplete/Inaccurate Recalls, Differences, and Signed Ranks for Wilcoxon Test of Retention Interval.

Subj.	5wks	4wks	3wks	Diff/Rank (5wk-4wk)	Diff/Rank (4wk-3wk)	Diff/Rank (5wk-3wk)
1	--	10	10	--	0/ --	--
2	20	20	--	0/ --	--	--
3	--	30	--	--	--	--
4	--	30	--	--	--	--
5	30	20	20	10/ 1.5	0/ --	10/ 1
6	40	30	20	10/ 1.5	10/ 1.5	20/ 2
7	50	50	--	0/ --	--	--
8	--	0	30	--	-30/ -2	--
9	--	20	20	--	0/ --	--
10	--	60	20	--	40/ 3	--
				--	--	--

Table X: Percentages of Incomplete/Inaccurate Recalls, Differences, and Signed Ranks for Wilcoxon Test of Level of Participation.

Subj.	Pers	Conn	Obser	Diff/Rank (Conn-Per)	Diff/Rank (Obs-Conn)	Diff/Rank (Obs-Per)
1	25	0	4	-25/-1.5	04/ 1	-21/-3.5
2	0	50	21	50/ 3.5	-29/ -6	20/ 3.5
3	0	0	36	0/ --	36/ 7	36/ 7
4	0	--	30	--	--	30/ 6
5	0	0	25	0/ --	25/ 5	25/ 5
6	0	25	32	25/ 1.5	07/ 2	32/ 7
7	50	100	43	50/ 3.5	-57/ -8	-07/ -1
8	0	0	18	0/ --	18/ 3	18/ 2
9	--	0	21	--	21/ 4	--
10	0	100	39	100/ 5	-61/ -9	39/ 9

T=1.5, n.s. T=23, n.s. T=4.5, p<.025

not remembered as inaccurately as Observed plays.

Again no differences were found between the levels of action frequency nor between positive and negative plays. These data are contained in Table XI and Table XII, respectively.

Finally, analyses were conducted on the percentages of No Memory recalls for each variable. This is an examination of the amount of forgetting over each level of the four variables.

As Table XIII demonstrates, no differences were found between the 5 week and 4 week retention intervals ($N=5$, $T=3.5$, n.s.) and no analysis could be conducted between the other two pairs.

There was a significant difference between Personal and Observed levels of participation ($N=8$, $T=5$, $p<.05$), but no differences were found between Personal and Connected or Connected and Observed levels, as Table XIV shows.

Unlike with "Complete/Detailed" and "Incomplete/Inaccurate" recalls, there were significant differences observed for frequency of action. Although there are no differences between Single and Few, Few and Several ($N=8$, $T=5$, $p<.05$) and Single and Several ($N=10$, $T=7.5$, $p<.025$) were significantly different. This indicates that the frequency of action does affect whether events are forgotten or not. Single and Few categories are not forgotten as much as events with very frequent actions. Table XV contains the analysis of

Table XI: Percentages of Incomplete/Inaccurate Recalls, Differences, and Signed Ranks for Wilcoxon Test of Frequency of Action.

Subj.	Single	Few	Several	Diff/Rank (Few-Sin)	Diff/Rank (Sev-Few)	Diff/Rank (Sev-Sin)
1	0	06	06	06/ 1	0/ --	06/ 2
2	50	38	0	-12/ -4	-38/ -7	-50/ -9
3	0	40	25	40/ 8	-15/ -3	25/ 5
4	100	40	0	-60/ 9	-40/ -8	-100/-10
5	33	25	17	-08/-2.5	-08/ -2	-16/ -4
6	33	50	6	17/ 6	-44/ -9	-27/ -6
7	0	75	44	75/ 10	-31/ -6	44/ 8
8	25	11	14	-14/-5.5	04/ 1	-11/ -3
9	25	11	29	-14/-5.5	18/ 4	04/ 1
10	25	33	57	08/ 2.5	24/ 5	32/ 7
				T=10, n.s.	T=9, n.s.	T=23, n.s.

Table XII: Percentages of Incomplete/Inaccurate Recalls, Differences, and Signed Ranks for Wilcoxon Test of Positive and Negative Plays.

Subj.	Positive	Negative	Diff/Signed Rank
1	0	10	10/ 5
2	17	14	-03/ -1
3	0	43	43/ 9
4	33	29	-04/ -2
5	20	25	05/ 3
6	30	30	0/ --
7	17	57	40/ 8
8	29	8	-21/ -7
9	14	23	09/ 4
10	29	46	17/ 6
			T= 10, n.s.

Table XIII: Percentages of No Memory Recalls, Differences, and Signed Ranks for Wilcoxon Test of Retention Interval.

Subj.	5wk	4wk	3wk	Diff/Rank (5wk-4wk)	Diff/Rank (4wk-3wk)	Diff/Rank (5wk-3wk)
1	70	60	60	10/ 1.5	0/ --	10/ 1
2	70	40	--	30/ 5	--	--
3	--	40	--	--	--	--
4	--	40	--	--	--	--
5	60	40	40	20/ 3.5	0/ --	20/ 3.5
6	60	50	40	10/ 1.5	10/ 2	20/ 3.5
7	10	30	--	-20/-3.5	--	--
8	--	60	60	--	0/ --	--
9	--	80	70	--	10/ 2	--
10	--	30	40	--	10/ 2	--
				T=3.5, n.s.	--	--

Table XIV: Percentages of No Memory Recalls, Differences, and Signed Ranks for Wilcoxon Test of Level of Participation.

Subj.	Pers	Conn	Obser	Diff/Rank (Conn-Per)	Diff/Rank (Obs-Conn)	Diff/Rank (Obs-Per)
1	25	0	79	-25/-1.5	79/ 8	54/ 5
2	0	50	71	50/ 4	21/ 3.5	71/ 7
3	0	100	38	100/ 6.5	-62/ -7	38/ 2
4	50	--	50	--	--	0/ --
5	0	100	40	100/ 6.5	-60/ -6	40/ 3
6	100	50	48	-50/ -4	-02/ -1	-52/ -4
7	25	0	21	-25/-1.5	21/ 3.5	-04/ -1
8	0	50	65	50/ 4	15/ 2	65/ 6
9	--	100	74	--	-26/ -5	--
10	0	0	89	0/ --	89/ 9	89/ 8
				T=7, n.s.	T=19, n.s.	T=5, p<.05

Table XV: Percentages of No Memory Recalls, Differences, and Signed Ranks for Wilcoxon Test of Frequency of Action.

Subj.	Single	Few	Several	Diff/Rank (Few-Sing)	Diff/Rank (Sev-Few)	Diff/Rank (Sev-Sing)
1	38	75	75	42/ 8	0/ --	0/ --
2	50	38	78	-12/ -2	40/ 8	28/ 4
3	0	40	50	40/ 6.5	10/ 2.5	50/ 6.5
4	0	40	50	40/ 6.5	10/ 2.5	50/ 6.5
5	33	33	67	0/ --	34/ 7	34/ 5
6	17	42	75	25/ 5	33/ 6	52/ 10
7	67	0	22	-67/ -9	22/ 5	-45/ 6
8	50	57	57	17/ 3	0/ --	07/ 3
9	75	78	71	03/ 1	-07/ -1	-04/-1.5
10	25	44	29	19/ 4	-15/ -4	04/ 1.5
				T=11, n.s.	T= 5, p<.05	T=7.5, p<.025

the percentages of No Memory recalls for frequency of action levels.

Again no difference was found between positive and negative plays. Table XVI reflects the analysis of this data.

Table XVI: Percentages of No Memory Recalls, Differences, and Signed Ranks for Wilcoxon Test of Positive and Negative Plays.

Subj.	Positive	Negative	Diff/Signed Rank
1	80	60	-20/ -7
2	50	57	07/ 3
3	33	43	10/ 4.5
4	33	43	10/ 4.5
5	30	55	25/ 8
6	60	45	-15/ -6
7	17	21	04/ 1
8	43	69	26/ 9
9	71	77	06/ 2
10	57	23	-34/-10
			T= 23, n.s.

CHAPTER IV

DISCUSSION

The purpose of this research was to use a new methodology and to observe four factors that influence how well personal experiences are remembered. There are some advantages and limitations in using videotape to record events to be remembered. There was evidence to support most of the hypotheses and implications for further research and theory. These issues are discussed below.

Methodology

Using videotape to obtain an original record of the events to-be-remembered seems to be of value for the study of autobiographical memory. By using videotape, more than one subject can participate in recalling the same event, as opposed to diary studies. Video allows the subject to experience the event naturally, avoiding the problem of having the subjects write the event to-be-recalled and rehearsing what will be recalled. In this study the factors being studied were not self-reported by the subjects. By having the events on video, the experimenter could observe and code different characteristics to study. These advantages of using videotape are valuable to the researcher interested in real-world memory, and further research using this method should be considered.

Along with the advantages of using videotape, there are

some disadvantages. Many natural experiences are inconvenient to videotape. When one goes to class, goes out with friends, or gets together with family, one does not always have a camera available to capture every moment on tape, nor does one care about doing so. Further research endeavors using video would have to consider the effort that would be involved to record the events to-be-remembered. A basketball season is easily recorded, but there may be other areas in which video can be used. One will be discussed below.

Research Questions Answered

The first question that was posed dealt with the accuracy and quality of memories over different retention intervals. It was expected that the larger the retention interval, the less accurate and complete memory would be. There was evidence that longer retention intervals negatively affect memory. Probabilities below twenty percent were observed between 4 week and 3 week intervals and 5 week and 4 week intervals, according to the Sign Test. Despite no significant differences on the Wilcoxon test for retention interval, the low binomial probabilities on the Sign Test indicate that most subjects' memory performance was worse with longer retention intervals. Possibly with more subjects in the pairs of groups in the analyses, differences would be more evident and stronger conclusions could be drawn about how much memory is affected.

The second research question asked whether events in which the subject is the central participant are remembered better. It was hypothesized that personal events would be remembered more completely and accurately. In fact, that was the most consistent finding in the study. Most striking were the differences in mean memory score and percentages of recalls in each memory quality category between Personal and Observed events. The Sign Test revealed very low probabilities between these levels and the Wilcoxon test revealed several significant differences at the .05 level. Differences were observed between Personal and Connected events as well. This suggests that memory is designed to hold onto more detail when the event personally involves you. When one is personally involved in an event that significantly affects one (successful, not successful, injured, humiliated, or any other outcome that may occur), he or she will encode, store, and retrieve more of the detail accurately than if the event only moderately affects your personal situation or does not affect it at all. Just as Rubin and Kozin (1984) found that subjects' most vivid memories were rated high on personal importance, these results support the notion that personally important events will be remembered well.

Implications of these findings for theory are clear. The events that one may experience vary as to how important they are to the individual. Memory will preserve more of the information for those events that are more important. By

preserving more of the information, the individual is better able to prepare for the same situation or similar situations in the future, in order to either repeat the actions that were successful and made him or her feel good, or to act in a way that will be more successful and pleasing than the previous experience. The Law of Effect states that actions that result in some consequences will be repeated and those that result in other consequences will be avoided. The results of this study suggest that autobiographical memory preserves more of the information for those activities that should be repeated or avoided in the future. Neither the reconstructionist or partial reconstructionist views consider the impact that personal importance has on accurate and complete memory.

The third question asked whether events that include infrequent actions will be remembered better than those that include actions that are frequently repeated. It was expected that infrequent events would be remembered better. The results of the Sign and Wilcoxon Test indicate that any differences in frequency of action only occur with respect to forgetting. There were very low probabilities associated with the differences between Single and Few and between Single and Several levels on the Sign Test of percentages of No Memory recalls. The only significant differences between levels of action frequency on the Wilcoxon test was observed for percentages of No Memory recalls, particularly between Few and Several and between Single and Several levels. In other

words, although from the analyses it cannot be concluded that action frequency is associated with high quality memories or low quality memories, it is associated with forgotten experiences. Those events that happen more frequently cannot be recalled.

Brewer's (1986) partial reconstructionist view of autobiographical memory contends that repeated experiences will produce generic memories, including general visual images that may be a combination of several experiences. This would suggest that more Incomplete/Inaccurate recalls would be observed for repeated events. This was not the case in this study. Possibly a partial reconstruction theory may be better explained by including the personal importance variable. Those events that are very nearly relived are those events that are more important to the individual that experiences the event.

The final question was whether positive or negative plays were remembered better. Prior research suggested that negative memories disappear after a while. It was suggested that negative memories may not disappear when it is vital to future performance to remember them. In basketball it is important to learn from mistakes. In fact, no significant differences were observed on the Wilcoxon tests for positive and negative plays. There was one probability less than .20 in the Sign Test of percentages of No Memory recalls, yet over the several analyses the memory performance on positive and

negative plays was about equal.

One implication may be that negative plays may not have had time or enough interference to disappear. Five weeks was the longest retention interval. It may be that memory operates in a way to preserve negative events in the short term (a few months) to provide the individual knowledge about certain situations, but over time they will be forgotten (Linton, 1986) and allow the individual to maintain a positive view of himself or herself.

Limitations

Despite the implications already discussed with respect to the research questions, there are some limitations which must be considered. Primarily, the study involves short retention intervals. Also, the sample is very small and not representative of the entire population of individuals. Finally, many factors that affect memory have not been observed or controlled in this study.

The short retention intervals were out of the control of the experimenter. The basketball season was originally scheduled to include five games. This would have provided two more retention intervals and more to remember. The last two games of the season were canceled. The term ended six weeks later and subjects were unable to be reached for further recall tests conducted with longer retention intervals. Further research should attempt to use longer retention

intervals to observe the nature of autobiographical memories over time.

In order to be able to make broad statements about how autobiographical memory operates, there must be an effort to draw larger, more representative samples. Autobiographical memory research has a difficult time obtaining large samples. Linton and Wagenaar each used a single subject, themselves. Barclay and Wellman (1986) used six subjects in their research. Brewer (1988) used ten subjects. This study used ten young adults. Although there was a small number of subjects, other researchers have experienced the same problem with obtaining larger samples. It would be valuable to conduct a study that remedies the small sample problem. Broader conclusions could be drawn if a larger, more representative sample were used in autobiographical memory research.

Many variables are not considered in this study. Emotionality, surprise, consequentiality, and rehearsal, to list a few, are not measured or controlled. These variables have been found to affect autobiographical memory in previous research. One aim of this study was to avoid having the subjects self-rate variables, which is how these variables have been measured in previous research. A more complete examination of autobiographical memory must either find new ways to measure all the factors at once or at least include self-rating scales to obtain some measure of variables, such as emotionality.

Suggestions for Further Research

One direction that may be interesting to follow using videotape as the original record of the events to-be-remembered, is to recruit families who have large video libraries of events in their lives and have them attempt to recall what happened on different occasions. One could argue that basketball is not like many events in everyday life. Basketball involves a lot of action in a short amount of time. By using video cassettes that families have collected over different events, it may be possible to study autobiographical memory of events that are truly everyday events that more individuals are likely to experience. Although this a potentially useful research approach, many of the problems already mentioned would have to be addressed. One factor that would have to be considered in a study of that nature would be rehearsal. Since the videos are those that possible subjects obtained and collected themselves, they will have had the opportunity to watch them one or more times. Despite the problems, however, this would be an interesting and ecologically appropriate method for studying autobiographical memory.

One question that could be addressed in the future is, "to what extent do individuals phenomenally relive their personal experiences?" Brewer's partial reconstruction view contends that some events are very nearly "relived". Some events are remembered so vividly that they involve a

phenomenal reexperiencing of the event. Brewer's conclusions are based on self-report data and its correspondence with accurate recalls. How can we know if an experience is nearly relived?

One way that this author intends to examine this question is to observe how well individuals can recall where they are in relation to others and other objects. It seems that if one can recall an event and place himself or herself in the correct location and place other individuals and other objects in the correct location in relation to himself or herself, some indication of the phenomenal experience can be obtained. This type of information was obtained from the subjects in this study and further organization and analysis of this data will be conducted to address the issue of reliving an event.

Conclusions

This study used videotape to study autobiographical memory. This is a novel and useful method for obtaining events to-be-remembered and with some effort could be valuable in studying autobiographical memory in other settings.

There was some evidence that suggests that over longer retention intervals autobiographical events are less accurate, incomplete, and forgotten more frequently than for shorter intervals. There were too few subjects to conduct analyses of data associated with different retention intervals and draw

any strong conclusions concerning the quality of autobiographical memories over time.

The most consistent finding was that plays in which the subject is the central participant are remembered more completely, more accurately, and forgotten less than plays in which he is either moderately involved or not involved. It is suggested that theories of autobiographical memory must include the notion that personal importance affects the quality and accuracy of memory.

The frequency of action variable only seems to affect whether an event is forgotten and not the quality or accuracy of the memory. When an event includes actions that occur frequently, one is likely not to be able to recall what happened.

Finally, there were no significant differences observed between positive and negative plays. Prior research found that negative events were forgotten. That was not observed in this study. Negative events may be remembered for a short time then forgotten later to protect the self-image.

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