

A COGNITIVE APPROACH TO EYEWITNESS  
EXPERIMENTAL DESIGNS

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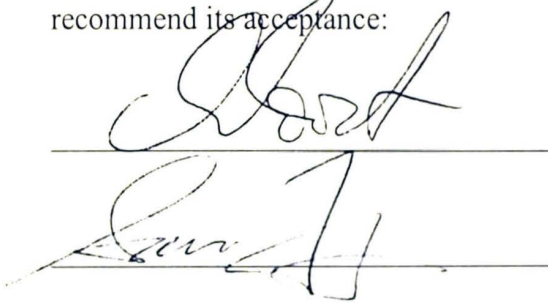


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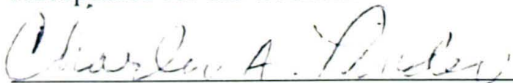
I am submitting herewith a thesis written by James Patrick Allington entitled "A Cognitive Approach to Eyewitness Experimental Designs." I have examined the final paper copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Masters of Arts in Clinical Psychology.

  
Dr. Charles Grah, Major Professor

We have read this thesis and  
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RUNNING HEAD: a cognitive approach

A COGNITIVE APPROACH TO  
EYEWITNESS EXPERIMENTAL DESIGNS

A Thesis  
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## Abstract

The purpose of this research was to investigate a more ecologically valid laboratory approximation of eyewitness testimony. There is a wealth of information dealing with how memory for events and recall conditions can effect and alter memory. This study sought to establish a quantitative bench mark for memory of nominal information in both normal and startle reaction situations. A simple recall task was used as a measure of both directed and incidental learning. Measures were taken by a tally of correct responses in both free recall memory tasks and an incidental learning task. The design was be 2X2X2, and the results were analyzed with a 2x2 mixed ANOVA, as well as a one way ANOVA. The hypothesis to be examined was twofold: a) that the control group would perform better on the second free recall task than the experimental group, and b) the control group would perform better on the incidental learning task. There were no major statistically significant findings for this project.

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## Chapter 1

### Introduction

#### Cognitive Theory

Memory is dependent on a few processes which must transpire for a memory to be formed. Each stage must be completed successfully for an event to be encoded in any useful fashion. If this process is disturbed or interrupted the event witnessed will not be recorded properly, if at all. If the memory is not recorded properly, then it can never be reconstructed or conveyed accurately. These processes will now be explored from a cognitive standpoint.

The first stage is that the event is attended. To attend to an event means that a person perceives and orients to an event or stimulus. If one does not perceive an event there is no input to be noted, and no memory will be made. If one does not orient to the event, likewise, the event will not be recorded. Specifically, this means that any event or stimulus in question must be consciously perceived before anything else can happen if a person is to be able to discuss what transpired. During the observation period and after the stimulus is observed, it is encoded in specific parts of the brain and there is a series of chemical and physiological alterations as the sensory input is consolidated. This means that an electro-chemical impression of the event is retained in the memory in some capacity. Consolidation is the process of fixing the memory in the brain for long term storage. If it is not consolidated, the memory will disappear, much like an unfamiliar phone number would soon disappear. As this practical example implies, consolidation does not always happen. It is a process that must be maintained, because once it is no longer maintained the memory disappears. After the event has been attended to, and has



been encoded in the mind, it must then be accessed and reconstructed to bring forth the phenomenon known as memory. This is a relatively elegant yet sometimes rather unreliable undertaking of the function and interplay between attention and recall.

It has been further postulated that forgetting can take place at many instances during the entire process and even after the process is completed. If the event was not given enough attention, it would be impossible for it to have been recorded into memory. Memory is malleable and can be pulled out of congruence with fact. Likewise, what a person retains in memory and sincerely holds to be true can be in error. (Bower, 1993) Flashbulb memories (brief, vivid flashbacks or recollections of a past emotionally charged event or situation), are perhaps the most poignant examples of recollection of a personal nature. However, these vivid and seemingly clear snapshots of the past are in general notably modified from the actual events in question, especially when there is a strong personal component present. (Bower, 1993) While there have been great innovations in the knowledge available through the laboratory experiments dealing with eyewitness testimony and its alterations, all of these approximations have fallen short in one essential respect. That respect is that they were not ecologically valid.

Events during encoding can also affect or even nullify memory. Physical trauma, mental trauma, or chemical influences can render encoding incomplete or impossible. Under circumstances such as these, it is unlikely that accurate memories could be formed or retrieved. Another complicating factor is the concept of state dependent memory, in which a person has an easier time recalling an event when he is placed in the same or similar circumstances. (Lang, Craske, Brown, & Ghaneian, 2001)

Finally, there is another well established cognitive concept that is known simply as decay. This is the natural tendency for time and entropy to erode memory. From the time of consolidation onward, there is a rapid and steady decline in a person's ability to access or recall anything in memory. The longer an event exists in memory, the more details and concepts are forgotten, until the information disappears completely. Strangely, most everyone will claim that their recollection of events in the past remains unaltered. This overconfidence in the integrity of memory is natural, as far as the individual is concerned. While rehearsal extends the half-life of memory, it is only a temporary reprieve from the inevitable. (Schacter, 1999)

### Past Research

As the phrase implies, eyewitness testimony is a recollection given after exposure to an event. Since we as a species are so heavily oriented toward vision, visual memory is usually what we are queried about most often after an event has taken place, especially when the law is involved. As the name implies, an event must be witnessed, remembered, and then later recalled. The recollection must not occur until some amount of time has transpired. After that period of time the information must be reconstructed and presented, often either in oral or written form. Traditionally, there have been two basic lab paradigms to assess this form of memory. One method is to show a film, or series of films, and then assess the participants afterward. (e.g., Dutton & Carroll, 2001; Loftus & Loftus, 1980) The other method is to show a series of slides, and then assess the participants in a similar fashion. (e.g., Tay, 1995; Safer, Christianson, Autry, & Oosterlund, 1998; Joseph, 1998; Joseph, 1999; Aikins, 2000; Gendron, 2001) Although there are some subtle variations in both methods of assessment, for the most part the

research methods fall into one category or the other. Out of these projects, a few possible explanations of how this specific form of memory functions were established and refined.

One of the most significant discoveries is how malleable memory can be. For example, the following is a paraphrasing of the experiment described by Loftus and Loftus in 1980. A group of participants were shown a film depicting a traffic accident between a red truck and a blue car at a yield sign. After watching this film, the participants would receive a questionnaire dealing with the specifics of what they had just viewed. In some questionnaires, the details were slightly altered so that new idiosyncratic elements not present on the tape were introduced. For instance, the red truck could become a yellow sport utility vehicle on the questionnaire, even though no yellow sports utility vehicle was present at all. Or something specific could be added, such as the blue car striking a pedestrian before hitting the other vehicle, even though there was no pedestrian on the tape. In another instance, a yield sign in the questionnaire could be replaced with a fictitious stop sign. The participants would then typically come back for another questionnaire with misleading details. Each participant's memory of the video was found to be reshaped dramatically by the false questions, especially when the wording was emotionally charged. A robust tendency toward being misled by situation specific yet openly false details became apparent by this paradigm. By virtue of the misleading information incorporated into the questionnaires, the participants molded their memories to accept this new and entirely false information.

Perception colors everyone's world. There is a tendency to remember things and people according to one's past experiences and personal biases. Put more directly, there exists a prominent in-group versus out-group bias with regard to the memory of a



perpetrator of a crime. People tend to remember a perpetrator as the type of person that they believe would commit such an act, instead of as the individual that they actually saw. Eyewitnesses would remember the acts as being carried out by minorities when in fact, like in the car accident study mentioned above, no such individual was actually in the material presented. (Lindholm & Christianson, 1988) Additionally, the participants in the car accident study were absolutely certain that their recollections were accurate.

This effect posed theoretical questions for the disconnection between tangible reality and an individual's recollections of the event in question. When the disconnection was researched, a few themes became apparent. First, there was a natural tendency for a person's perception and expectations to color what was recalled. For instance, people recalled a negative activity as being carried out by a person ethnically unlike themselves, while positive acts were generally attributed to a person ethnically like themselves. (Lindholm & Christianson, 1998) When the exposure to the event in question was less clear, the amount of false reconstruction of memory by the individual participant increased. Likewise, the nature of the stimulus presented affected recall. For both actual and laboratory situations, a form of skewing of attention took place. (Gendron, 2001; Dutton & Carroll, 2001; Aikins, 2000; Bradley & Lang, 2000; Safer et al, 1998; Tay, 1995, Kassin, Tubb, Hosh, & Memon, 2001; Kebbell & Wagstaff, 1996; Ratzen & Markham, 1992; Skolnick & Shaw, 2001)

Case studies began to reveal how important attention was to the phenomena of eye-witness testimony. In real-life settings, a tendency of the observer to focus on what is considered most important in a situation became apparent. There was a physiological component for this selection of focus, which will be discussed in depth later.

A person's natural tendency is to orient to the most important, noticeable stimulus. In the case of survivors of violent crimes, the weapon was chiefly attended. (Kassin, et al, 2001; Kebbell & Wagstaff, 1996; Rantzen & Markham, 1992; Skolnick & Shaw, 2001) When questioned about the specifics of the event, many reported only seeing an impossibly large weapon looming in their general direction. Research has established this over-exaggeration of a certain specific stimulus to the detriment of all others as quite normal.

This concept of weapon focusing lead to the next great additions to the research: the concepts of tunnel vision and detail selection. (Kebbell & Wagstaff, 1996; Bower, 1993; Loftus & Loftus, 1980; Kassin, et al, 2001; Skolnick & Shaw, 2001; Gendron, 2001; Dutton & Carroll, 2001; Aikins, 2000; Safer, et al, 1998; Tay, 1995) How those stimuli were perceived had perhaps the most profound effects on the participant's ability to perform memory tasks, especially so when the participant was assessed for their recollections of what they had witnessed. A person's impression of the event to which they had been exposed is essential to the mechanisms of memory and material.

There is some question as to whether this arousal caused by an aversive stimulus enhances or inhibits memory formation and recall. As the phenomenon of weapon focusing implies, the nature of the stimulus can enhance central detail at the expense of peripheral detail. Likewise, the inverse can be true in that peripheral information can be

enhanced while central detail is lost (Gendron, 2001; Dutton & Carroll, 2001; Izquierdo & McGaugh, 2001; Kassin, et al, 2001; Markowitsch, Thiel, Reinkemeier, Kessler, Koyuncu, & Wolf-Dieter, 2000; Aikins, 2000; Bradley & Lang, 2000; Joseph, 1999; Joseph 1998; Safer, et al, 1998; Tay, Kebbell & Wagstaff, 1996; 1995; Christianson, Bower, 1993; 1992; Burke, Heuer, & Reisberg, 1992; Brown & Kulik, 1978). However, this is mainly due to the nature of, and more importantly, how the stimulus is perceived. When the participants were given an opportunity to review the stimulus in terms of affect, the ones which were perceived as pleasurable were better remembered than stimuli that were perceived as aversive. (Bradley, &Lang, 2000; Lang, et al, 1990) In fact, a robust curve has been identified when memory of events is plotted against affective ratings of the presented stimulus. (Gendron, 2001; Dutton & Carroll, 2001; Izquierdo & McGaugh, 2001) This effect is present in the same form for both visual and acoustic stimuli. In summary, how pleasant or aversive nature of an event was perceived by the individual had a great deal of impact on their ability to recall events. (Gendron, 2001; Dutton & Carroll, 2001)

All of this research was ideally aggregated around the concept of eyewitness testimony, a simple fact that reveals a subtle flaw in the research. Assessing memory for details in a filmstrip or in a slide show is not an instance of eyewitness testimony; it is a measure of a subject viewing presented information. In essence, this was no different from quizzing people leaving a movie theater on nominal details such as the race of the characters, the major plot points, the locations, and the clothing worn in the movie. This is not eyewitness testimony, because the participant did not have a chance to orient naturally but is forced to select where to orient according to what was presented. Also,



an integral component was that the individual is both involved and personally invested in the event that he or she was questioned about. The regular oversight in the research was that researchers have not established exactly how accurate a single person's recall was after being personally exposed to an unpleasant stimulus and then asked to recall the specifics of the stimulus.

### Present Study

Many of the past experiments that involved watching videos, or focusing on weapons did provide a framework for understanding the gravity of the modifications that questioning can provoke and the focusing caused by the presentation of a clear, finite threat such as a weapon. However, neither truly addresses how accurate recall is just after witnessing an event. Memory cannot naturally be improved from that first level. In fact, time alone begins to warp and erode the recollection immediately. Leading questioning or information from a trusted source skews the recollection further and further away from the objective reality. (Joseph, 1999)

To grasp the root of being an eyewitness with respect to ecological validity, the set-up must be proximal and live. After establishing the physicality of an event, the specific details must be reconstructed on the part of the participant and obtained in an objectively measurable format. Extraneous recall could include information such as gender, height, weight, ethnicity, make, model, license plate and other specific features of an event if they were not central or prominent. Since these details are not exactly central to the event a person has witnessed, they can be considered incidental rather than deliberate learning. Likewise, memory will never be more accurate than just after encoding has been completed, and therefore this is a critical moment to analyze exactly

how accurate or poor memory is, for it will never improve. Even with maintenance, memory can only degrade and be reformed.

When a person is an eye-witness, that person is generally asked to recall two basic types of information. One is the nature of the event. The other type of information a person would be queried about would be specifics of the event. The issue with having a person presented with photographs or videos is that primarily a person can not orient to the situation in question naturally. For instance, if a person was near an accident, they may have cringed defensively and not actually seen the accident. In which case, showing a film of an accident, the individual watching the tape would be forced to select how they orient as filtered through the camera lens. The use of film was an unnatural filtering and was not true to everyday human experience. The individual must be free to react and orient in order for the experimental conditions to be ecologically similar and therefore ecologically valid measures of memory. Furthermore, a person can miss visual input whether purposeful or accidental. It is far more difficult to miss or ignore sound, especially when it is relatively loud, close by, and unexpected. Therefore, a recording of a fire alarm was used as the noxious stimulus.

Fire alarms were also selected for a few other inherent properties. Most importantly, the alarms are designed to be heard, and are loud enough to startle an unsuspecting person without causing ear damage. Also, fire drills are regular parts of public buildings, especially schools. Fire drills arguably have rendered fire alarms a semi-regular experience by the time an American has reached adulthood. Moreover, while the vast majority if not all times a person has heard a fire alarm it was during a drill. Another key feature of the fire alarm is precisely that any time an alarm was sounded, it

may or may not have been a drill. Therefore each time an alarm was sounded, the alarm represents a possible threat to self, much like if a person had been an eyewitness. An event, such as an automobile accident, that did not directly involve an individual carries a sense of threat and the possibility of personal harm.

However, since this experiment involved deception and the use of an intentional startle stimulus, participants were screened. The participants were allowed to excuse themselves without question. However participants were screened out if they met any of the following criteria: third trimester pregnancy, cardiac or pulmonary troubles, panic or stress-related disorders, hearing impairment, a tendency toward seizures, and color blindness. The last three, (hearing impairment, seizures, and color blindness) were not merely health exclusions, but also pertained directly to the experimental procedure. The participants had to be able to hear well enough to be startled by the alarm as well as to be able to accurately discern between the colors presented.

In order to quantify how much a person could recall, the participants were asked to recall words presented in two lists. Afterward they were asked to perform an incidental learning task. This project is predicated on the notion that incidental learning would be the best measure of eyewitness testimony.

Two word lists were created, each contained fifty-eight words per list were selected from a standardized word norm (Thorndike & Lorge, 1944) to be words on the seventh grade reading level and having three syllables whenever possible. Words that started in unusual letters, such as q, z, and x were under represented and generally could not meet the three syllable criterion. Words that were heavily represented, such as those that start with s, d, and t were more common in the word list in order to approximate their



natural occurrence. None of the words were repeated. Each of the words was presented individually in one of the following colors: blue, green, red, purple, or black. The words were then randomized for each list.

The raw numbers of words recalled from the lists were to provide additional information to supplement the notion that incidental learning may have been the best measure but also to create a qualitative benchmark for this experiment in general. The hypothesis examined was twofold: a) that the control group would perform better on the second free recall task than the experimental group, and b) the control group would perform better on the incidental learning task.

## CHAPTER 2

### Method

#### Participants

Thirty-eight undergraduate and graduates students taking psychology classes at Austin Peay State University who were at least eighteen years of age participated in this study. No other identifying information was gathered. Each participant was given a voucher that could be exchanged for extra credit at the discretion of their instructors. All participation was voluntary. However, since this experiment involved deception and the use of an intentional startle stimulus, participants were screened. The participants were allowed to excuse themselves without question. Participants also were screened out if they met any of the following criteria: third trimester pregnancy, cardiac or pulmonary troubles, panic or stress-related disorders, hearing impairment, a tendency toward seizures, and color blindness. The last three, (hearing impairment, seizures, and color blindness) were not merely health exclusions, but also pertained directly to the experimental procedure. The participants had to be able to hear well enough to be startled by the alarm as well as to be able to accurately discern between the colors presented. Screening people who were prone to seizures was a protective measure because of the way that the words were presented. The presentation of the word lists will be discussed later in this section.

The participants were assigned to either the control group or the experimental group in an alternating basis. (i.e., the first participant was assigned to the control group; the second was assigned to the experimental group and so on). Since there was an even number of participants, this method effectively balanced the groups with nineteen

participants in each group. The participants were tested individually in the experiment.

### Materials

The students were tested in a small room, which had a computer on a desk and which had no windows. Under the desk, but not hidden was a speaker which was used to play a recording of an alarm for the experimental condition. The tone was tested at 90-95 decibels and was sounded for about ten seconds.

The two lists were each created in the same fashion. Fifty-eight words per list were selected from a standardized list (Thorndike & Lorge, 1944). The words selected were on the seventh grade reading level and had three syllables whenever possible. Words that started in unusual letters, such as q, z, and x were under represented and generally could not always meet the three syllable criterion. Words that were heavily represented, such as those that start with s, d, and t were more common in the word list in order to approximate their natural occurrence. None of the words were repeated. Each of the words was presented individually in one of the following colors: blue, green, red, purple, or black. The words were then randomized for each list.

### Procedure

After the participants had given consent, they were led to the testing rooms as described above. Two word lists were presented individually to the participants. The words were presented one at a time at a rate of one word every two seconds. Microsoft PowerPoint was used to present the words. The lists were presented in a counter balanced order, with half of the participants receiving list A first, and the other half receiving list B first. When the complete word list had, been presented, the screen would go blank. The participant was then directed to write on a blank piece of paper all the



words that could be recalled. When the participant stated that all the remembered words had been written down, the testing portion was considered concluded. There was no prescribed limit on how long the participant had to recall the words.

The second list was presented in exactly the same manner as the first list with the exception that participants in the experimental group were interrupted by the sound of the alarm as the presentation of the list ended. The alarm was played from the speaker under the desk for approximately ten seconds at 90 – 95 decibels. After the alarm was sounded, the researcher would go into the testing room and inform the participant that the alarm was an error and to ignore the disturbance. The participant was then given unlimited time to recall all the words that had been presented.

After signaling that all words that could be remembered from the second list had been written down, the participants were then asked to write the color that each word had been presented in. Since participants were not made aware that they would be asked to recall the color of the words, this provided a test of incidental learning. After the participants had concluded the incidental learning task, the experiment was concluded and they were completely debriefed as outlined above.

## Chapter 3

Results

Table 1.

Descriptive Statistics for both Control and Experimental Groups

		List 1 Recall	List 2 Recall	Incidental Learning
Control Group	Mean	6.789	6.526	2.316
	Standard Deviation	3.750	3.454	1.565
Experimental Group	Mean	6.158	5.474	1.474
	Standard Deviation	2.986	2.294	1.219

Please take note of the descriptive statistics laid out in Table 1, above. The raw data for the recall of the words were analyzed with a 2x2 mixed ANOVA. The variables measured were the raw number of correctly recalled words from each trial. The raw number of accurately recalled words was also compared between the control and the experimental groups as well as within these groups. There was no overall difference between the total number of words recalled by either group,  $F(1, 36) = .906, p > .05$ . Likewise, there were no difference identified between the first testing session and the second testing session with respect to the conditions of the experiment respectively,  $F(1, 36) = .792, p > .05$ . There were no significant interaction effects identified either  $F(1,$

36) = .156,  $p > .06$ . Essentially, there were no significant results found between any of the measures regarding the raw number of words recalled.



## Chapter 4

### Analysis and Interpretation

#### Analysis

The raw data for the recall of the words was analyzed with a 2x2 mixed ANOVA. There was no overall difference between the total number of words recalled by either group. Likewise, there was no difference identified between the first testing session and the second testing session with respect to the conditions of the experiment respectively. There were no significant interaction effects identified either. Essentially, there no significant results found between any of the measures regarding the raw number of words recalled.

A one way ANOVA was conducted on the data from the incidental learning task. This one way ANOVA was the only measure that approached statistical significance:  $F(1, 36) = 3.423, p < .1$ . However, it is clear that this result did not truly achieve statistical significance even though the tendency was in the expected direction. The experimental conditions could not recall as many colors that the words were printed in as the control group could as a whole..

#### Interpretation

The average number of words correctly recalled was about six on the first test for both groups, and too close to 6 on the second test for both groups to achieve statistical significance. Normally on a test of fifty-eight words, an average recall of around 11 would be expected. This suggests that perhaps this was a ceiling effect and the word lists were too difficult. The low number of recalled words could also be evidence of the

participants simply not being interested or vested in the experiment or their personal efforts.

Another curious result was that there was not a practice effect found in that the second time the participants were exposed to essentially the same task. This tends to solidify the notion that perhaps the task was too difficult. The average news paper is written on an approximately fifth grade reading level so as to ensure accessibility for a broad reading base. Even though college students should have been exposed regularly to material on and probably above the seventh grade reading level, it is possible were other variables within the list to render it so difficult. Some of the words, such as Greek words, or unusual of the words may have been unfamiliar to the participants, and therefore harder to recall. Also emotional valiance for a particular stimulus seems to improve memory. Words with obvious emotional meaning were avoided as to keep the stimuli as neutral as possible. However, these data were gathered near the close of the semester, and not too long before finals. It is possible that the stresses of closing the semester and the upcoming holidays may have imparted a significant immeasurable effect on this entire experiment. In other words, it may have been possible that the participants were not vested in the experimental tasks, and this had been shown in the unusual results.

Finally, it is possible that the sample sizes were simply too small. There were 18 participants in each group making for a combined pool of thirty-eight people. It seems quite possible the sample size was not large enough to avoid a Type I error. The one way ANOVA is so close to statistical significance it might have been possible that with more participants the effect could have been more robust. In fact it is this writer's opinion that even with the issue of how few words could be recalled, the most important

element would have been identified as having statistical significance. The incidental learning task was of course the most important theoretical tenet of this project. It lends credence to the notion that this study's theoretical tenets may have been correct. If this project were to be rerun, a larger number of participants would be almost mandatory as well as perhaps revising and simplifying the experimental tasks.



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