THE IMPACT OF EMOTION ON MEMORY AND MISINFORMATION ACCEPTANCE

By

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THE IMPACT OF EMOTION ON MEMORY AND MISINFORMATION ACCEPTANCE

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In memory research, two concepts that have received increasing attention are misinformation acceptance (believing you have seen or experienced something that was in fact only suggested to you) and the effect of emotion on memory. The present study was designed to investigate if there is any interaction between these two concepts. It was hypothesized that subjects who view an emotional scene would be more likely to accept misinformation suggested to them about the scene than subjects who viewed a neutral scene. It was also hypothesized that subjects who view an emotional scene will have better recognition for objects spatially close to the action, and poorer memory for objects peripheral to the action, than subjects who view a neutral scene. The study determined that subjects' memory for objects in the scene was generally the same, regardless of whether they viewed an emotional or neutral scene. For subjects who received misinformation about objects in the scene, a significant interaction suggested that subjects

who viewed an emotional scene were more likely to accept misinformation in some situations, compared to subjects who viewed a neutral scene.

CHAPTER 1
LITERATURE REVIEW

Introduction

In thinking about memory, it would seem that most of us have something of a split personality regarding its integrity. On the one hand we can acknowledge, and even find amusing, the inherent fallibility of memory. On the other, memory is depicted as a hidden storehouse of knowledge that holds the answers to any number of mysteries. Over the years, the nature and quality of memory has been examined and challenged by numerous experimenters attempting to answer basic questions about how we learn and store information. The fact that some information may be forgotten or distorted has never been surprising, or distressing. But in recent times the issue of accuracy in memory has taken on vastly increased importance. The current controversy regarding "recovered" memories has thrown psychologists, counselors, and experimenters into the center of a frequently ugly battle played out before the media. On the one hand, therapists dealing with memory of sexual abuse or other trauma risk have sometimes seen a patient suddenly recollect an emotional event from the past and have steadfastly argued for the reality of this phenomenon. However, in the absence of clear empirical support for this reality, such practitioners have often been labeled as "quacks" that aid and abet an agenda of blaming others for psychological problems. On the other hand, experimentalists who suggest that recovered memories may be distorted or completely fabricated may be

accused of being in denial and, in one extreme, of being part of a conspiracy of child abusers and satanists to cover up the truth [1]. Occupying a tenuous middle ground are those who argue that whatever one believes about concepts like repression and the possibility of recovered memory, the phenomenon of memory distortion is quite real. To acknowledge that fact is not to denounce the reality of a person's experiences, but rather to accept the challenge of determining what, if any, aspects of such memories have their roots in actual experience, and to accept the possibility that what a person remembers may only be an approximation of what actually occurred. In the world of forensics, where lives can turn on a single remembrance, it becomes crucial to understand the limitations of memory.

Early Memory Studies

The first systematic experimental study of memory began in 1885 with the German psychologist Hermann Ebbinghaus. Before that time, researchers limited themselves to obtaining anecdotal reports from subjects about their subjective experiences in order to hypothesize about memory and other cognitive processes. Ebbinghaus' use of nonsense syllables allowed him to control what the subject learned, and consequently measure learning and memory through strict scientific method. These early studies, by virtue of their method, reflect a certain philosophy about how memory is encoded and stored in the brain. Words become "units" of memory, and as a consequence the quality of memory was measured by how many "units" are recollected. In later studies, it was discovered that the presentation of a word or concept in a person's consciousness led to the activation, or "priming" of other, semantically related words or concepts, making them more likely to be recalled [2]. This phenomenon was known as

"spreading activation," and suggested that rather than being discrete units of information, words in memory were in fact associated with other words. In this general theory memory becomes a web of complex interconnections, with semantically related words associated with each other so as to provide a mechanism for the spreading activation phenomenon. However, the word is still the basic unit in this memory machine.

Contextualism

The associational view of memory had an eloquent challenger in 1974 with James Jenkins [3], who advocated a radically different viewpoint: that we remember contexts, not details. Jenkins believed that while memory was frequently studied in the laboratory as if it were an associational process, in reality it was more conceptual, based on contextual relationships. Jenkins hypothesized that specific details are not stored in memory, but that we learn overall contextual themes from which details can be later reconstructed. Jenkins's hypothesis was vividly demonstrated in his accompanying study, by which he had people learn various complex sentences, such as "The cat, running from the barking dog, jumped on the table." Later on Jenkins presented more sentences to his subjects and asked them if they had seen them before. He found that sentences that were similar to the target sentences were just as likely to be called "old" in a recognition test as were the target sentences themselves. Jenkins hypothesized that rather than remember the sentence as a group of individual words, the subject would encode the gist of the sentence. When presented with a similar sentence, the subject would not recognize that certain words had been changed, deleted, or added. Rather, the subject would reconstruct the content of the original sentence and determine if the new sentence had the same content. If it did, the subject would then determine that he or she had seen it before.

Thus, Jenkins' argument was that memory was *reconstructive* rather than *reproductive*. Each event had a quality as a whole, and it was this quality that was best remembered, not the individual details. What made the contextual view really different from a more associational view was the starring role given to the individual doing the remembering. As Jenkins put it, contextualism "calls us back to considering what the subject believes and knows when we talk of memory. It simultaneously suggests that we look to the sources of this belief and to the subject's ways of constructing and reconstructing his experience [3]." In other words, memory cannot always be counted on to accurately reproduce reality, as any recollection is inevitably affected by the individual's own perspective.

Schema Theory

While Jenkins did not use the term "schema," his discussion of contextualism was consistent with the schematic view of memory. The schematic theory, as described by Alba and Hasher [4], basically suggests that incoming information is encoded and stored based in large part on prior knowledge structures. They enumerated four major components of schema theory: *selection*, *abstraction*, *interpretation*, and *integration*. *Selection* refers to the process by which certain information is encoded, and certain information is not. According to the theory, whether or not a particular piece of information is encoded depends on that information's relevance to a previously existing schema that has been activated. The previous knowledge possessed by the individual may take the form of *theme* knowledge, or of *frame* knowledge. *Theme* knowledge refers to the phenomenon that the more an individual knows about a subject; the more easily they will acquire new information about that same subject. This has been demonstrated

using subjects such as baseball and chess. The existence of a previous schema facilitates the acquisition of new information that fits into the schema. *Frame* knowledge refers to the phenomenon that incoming information whose structure matches previous information will be more easily retained than knowledge whose structure does not match. For example, people required to memorize a 7-digit string may find themselves "chunking" the numbers into a 3-digit string followed by a 4-digit string, thus giving the overall string the structure of a telephone number. Because this structure has been used so frequently in the past, its familiarity may facilitate recall of the string. Because what information is selected is based in large part on previous knowledge, the theory postulates that a person's objective recall of any given situation will by necessity be incomplete. *Abstraction* is the next step in the encoding process. In this stage, information is encoded with respect to its meaning, but not necessarily its format. Thus, while the overall meaning of a sentence or paragraph may be retained, the precise wording and grammatical structure will not.

Both selection and abstraction involve reducing the amount of information that is to be remembered. In the *interpretation* stage, the subject makes inferences about the incoming information. These inferences are used to make vague information clearer, fill in missing detail, or simplify complex information. They can also lead to distorted recollections. In an example cited by Alba and Hasher [4], subjects who are presented with the sentence "The paratrooper leaped out the door," recall, "The paratrooper jumped out of the plane." The subjects' inferences about the sentence led them to "recall" details that were never actually presented. *Integration* occurs either when a new schema is formed, or when an existing schema is modified. In either instance, the memory that is

created consists of incoming information that has been selected based on its perceived relevance to prior knowledge, combined with inferences the subject has made about the information. The bottom line for schema theory is that memory is not a verbatim record of events, but rather an amalgam of past and present experience. Schema theory provides an explanation for a variety of demonstrable memory distortions. Strohmer et al. [5] demonstrated just such a phenomenon when examining how counselors' previous hypotheses about clients affected their memory. They presented the counselors with narratives from these clients, then later tested recall for the narratives. The counselors tended to remember information that confirmed their previous hypotheses, rather than information that disconfirmed their hypotheses. This effect occurred even though the narratives contained more disconfirmatory than confirmatory information. Schema theory would explain such a distortion by suggesting that the counselors, while reading the narratives, filtered the new information through their preconceived notions and so gave more emphasis to the confirmatory information, resulting in better encoding and consequently better recall for such information.

While schema theory accounts for some examples of memory distortion, an alternative body of research examined by Alba and Hasher suggests that some central tenets of schema theory are not correct. A major component of schema theory is that the amount of information taken in by a subject is drastically reduced through the processes of selection and abstraction. However, Alba and Hasher conclude that in reality, memory for complex events is in fact quite rich and detailed, which schematic theory does not allow for. Schema theory is useful in explaining memory functions in the laboratory, but has a more difficult time accounting for memory as it occurs in everyday life. Like

Jenkins' contextualist theory, schematic theories of memory make the individual the primary determinant in how new experiences are encoded and recollected. However, Alba and Hasher complain that most schematic theories are constructed with the specific aim of explaining certain kinds of memory distortions and so fail to adequately explain how memory, on most occasions, can be quite accurate even for very complex events. Given this, schema theory operates better as an explanation for specific types of errors than as a more global theory of memory.

MEM Theory

Marcia Johnson's MEM theory also attempts to explain various kinds of memory errors, while at the same time do justice to the complexity and richness of memory [6]. MEM, which stands for Multiple-Entry Modular Memory, holds that when an individual encodes a new memory he or she encodes a host of varying kinds of information. In addition to the semantic content of the event, the individual encodes perceptual details, such as sights, smells, and sounds. The individual also encodes "contextual" information, defined by Johnson as a sense of when in time the event happened. Contextual information could include a link to what immediately preceded the memory in addition to what followed it, as well as remembering what day the event happened and when during the day (or night) it occurred. Finally, the individual encodes "cognitive operations," or a sense of the elaborative and reconstructive processes that took place during the formation of the memory. According to Johnson, it is the qualitative differences between these memory traces that allow an individual to determine where, when, and how they learned a specific bit of information. This "source monitoring" is potentially important, as it could allow a person to evaluate the quality of information. For example, learning a piece of

information from the National Enquirer as opposed to The New York Times could have significant impact on how seriously the information is considered. One example of a failure of source monitoring is the "false fame" phenomenon. Jacoby, Kelley, Brown, and Jasechko [7] had subjects read a list of names that were not famous. Later, they had those subjects read a new list and decide whether each name was famous or not. The new list contained famous and non-famous names, including several of the non-famous names the subjects read before. The subjects were more likely to judge the previously viewed non-famous names as famous than the new non-famous names. Jacoby et al. hypothesized that subjects presented with a previously viewed name may recognize it as familiar without remembering where they heard it. They may then decide that the name's familiarity is due to it being famous and so respond accordingly.

Source monitoring may fail for a number of reasons. According to Johnson, Hashtroudi, and Lindsay [8], source determinations depend on detecting qualitative differences in the memory of events; anything that prevents the individual from creating a fully formed "event," such as stress or divided attention, will reduce the amount of contextual information encoded and diminish the event's uniqueness and subsequent discriminability. In addition, if two events are semantically similar to each other there is potential for source confusion. For example, a person may remember hearing a certain joke at one party when in fact it was told at another party held a week earlier at the same house. Were the parties held at two different houses they would become more dissimilar from each other and thus more distinguishable.

In contrast, Jacoby, Kelley, Brown, and Jasechko [7] argued that recollecting an event or piece of information did not automatically give the individual a sense of where

they learned it. In other words, a piece of information was not intrinsically tied to knowledge of where that information was learned. Jacoby et al. hypothesized that source recollections involved a different retrieval process altogether. When they repeated their experiment and asked subjects to additionally report whether or not they had seen each name on a previous list, subjects became better at discriminating famous names from previously presented non-famous names. Jacoby et al. interpreted the results to indicate that since subjects were specifically asked to make a source judgment, they became more aware of the possibility that a name might be familiar because they had just seen it before.

One particular form of source monitoring is what Johnson and Raye [6] termed reality monitoring. Reality monitoring refers to the ability to determine whether a particular memory was originally generated externally (as a perceptual event) or internally (as a product of imagination or dreams). Johnson and Raye determined that perceived and imagined events are qualitatively different from each other, and it is this qualitative difference that allows individuals to determine where the memory came from. Perceived memories, they wrote, contained more perceptual detail than did imagined events. Perceived events also contained richer contextual information, such as when the event happened, what happened before, and what happened afterwards. Imagined events, on the other hand, contained more cognitive operations that served almost like a log of the memory's formation. Johnson, Hashtroudi, and Lindsay [8] suggested that recognition of cognitive operations could be used to identify the individual as the source of the memory.

Schooler, Gerhard, & Loftus [9] used descriptions of memories generated by subjects from a previous experiment and asked independent judges to classify the memories as being from actual events or as being products of imagination. When the

judges were given hints as to the kind of qualitative differences that exist between real and imagined memories, they became quite good at discriminating real from perceived events. However, their ability to discriminate deteriorated when they were not aware of such differences. In another study, Dodson and Johnson [10] had subjects look at photographs and read descriptive paragraphs of locations and situations. They found that many subjects falsely remembered seeing pictures that they had, in fact, only read about. This could be construed as another example of a failure of reality monitoring; the subjects who read the descriptive paragraphs may have visualized them, and then confused their own visualization with an actual perception. However, when the subjects were asked about the stimuli in a way that encouraged them to consider the source of their recollection, they produced fewer false attributions. These results are consistent with Jacoby, Kelley, Brown, and Jasechko's [7] hypothesis that source monitoring (in this case, monitoring where the event was externally or internally generated) is not always a spontaneous occurrence, and sometimes must be explicitly prompted.

Misinformation Acceptance

One potential effect of a difficulty to discriminate between potential sources of information is what Loftus and Hoffman [11] dubbed "misinformation acceptance." This phenomenon occurs when an individual, after observing some event, is given new information about a particular part of the event that is either inconsistent with what actually occurred or is a detail that was not actually observed by the individual. The individual may then recall this misinformation as if it were a memory of the observed event. An example of misinformation acceptance used by Loftus and Hoffman was of a man who witnessed a robbery in which the thief took a hammer. After the event another

witness told him that the thief stole a screwdriver; when he is interviewed by police and they asked him if the thief took a hammer or screwdriver, he tells them it was a screwdriver.

One possibility would be that the man did not actually see the thief take the hammer. In this instance the man would have created a new memory based on the other eyewitness's statement, perhaps by visualizing the thief taking a screwdriver, and then included it in his own memory of the event. If this were true, it would be an example of a failure of reality monitoring, misattributing an internally generated memory (the man's visualization of the other person's statement) as being a perceived memory. Johnson, Hashtroudi, and Linday [8] indicate that confusion about the source of memories (whether internal-external or external-external) increases when there is a high degree of perceptual similarity between the two sources. In the robbery example, the man's visualization of the other eyewitness's account would likely be extremely similar to his own perceived experience, and consequently easier to incorporate into his own experience.

Another possible scenario for the above account would be that the man did in fact see the thief take the hammer, but accepted the other person's account anyway. There is some controversy about the meaning of this type of error. One possibility would be that the man accepted the new statement as accurate and so reported it as his own memory even though he was well aware he did not see such a thing. This is also a potential explanation for the previous example where the man did not see the thief take anything, and is a problem of demand characteristics. The man wishes to be accurate, and so consciously misrepresents his own memory to be cooperative, or to avoid seeming stupid.

To see if misled subjects genuinely believe they have seen events presented as misinformation, Zaragoza and Lane [12] presented a slide sequence, then asked the subjects to take a memory test that incorporated misinformation about the slides. For example, a question would ask "When the man looked at his wristwatch before opening the door, did he appear anxious?" In fact, the man in the slide sequence was not wearing a wristwatch. After this test, subjects then took a recognition test for a series of items, including the wristwatch. A subject responding that he or she remembered a wristwatch could then be said to have accepted the misinformation. In the experiment, the subjects frequently accepted the misinformation as being true. Then, Zaragoza and Lane asked the subjects to make a source judgment, asking if certain information was seen (in the slide sequence), read about (in the questions), or both. A significant number of subjects indicated both seeing and reading about the misinformation, suggesting that they did indeed have a false memory. Note that this effect did not require the subjects to "forget" that they had read the misinformation, as they accurately reported reading about it. Consequently, the results do not seem to be the result of shifting the attribution from one source (the test) to another (the slide sequence). Rather, it would seem that the subjects were able to generate a visual image from the misinformation that was then incorporated into memory for the slides, but this process did not eliminate subjects' ability to acknowledge that they had read about it. In another effort to circumvent potential demand characteristics, Zaragoza and Lane told the subjects before the recognition test that some things they read about in the test they just took were not correct. They discovered that the warning made no difference; subjects who received it were just as

likely to accept the misinformation as subjects who received no warning. This again suggested that the subjects genuinely believed seeing items that they in fact did not see.

A second explanation for misinformation acceptance despite encoding the original event is that when misinformation is given, the original memory trace is present but inhibited from being recalled [13]. By this view, the misinformation is retrieved in place of the original memory. A third possibility is that the original memory was itself altered to incorporate the misinformation. Donders, Schooler, and Loftus [14] used a robbery sequence in an experimental setting, during which the thief can be seen taking a hammer. Some subjects were then misled that the thief had in fact taken a screwdriver. When presented with a forced-choice test ("Did you see a hammer or a screwdriver?"), a significant number of subjects chose screwdriver. In addition, those misled subjects who chose the screwdriver answered significantly faster than those who chose the hammer, suggesting a higher degree of confidence in their answer.

In examining the results of the Donders study, one possibility is that the subjects who were misled now had two sources of memory, the actual event and the misinformation. Perhaps those who eventually chose the correct answer of hammer did so because they recognized a discrepancy between what they had seen and what they were then told. But recognizing that there was a discrepancy and making a judgment about what they had actually seen made them take longer to answer than those who accepted the misinformation. By contrast, the control subjects who were not misled and chose the correct answer were faster in responding both in comparison to the control subjects who responded incorrectly and the misled subjects who responded correctly. The Donders study still does not resolve the issue of what happens to the original memory trace. It

does, however, show that misinformation can be accepted in the face of previous perceptions, and accepted with confidence.

Hypnosis and the Effect of Suggestion

In the Donders et al. [14] study, subjects who ended up accepting the misinformation answered significantly faster that subjects who ended up rejecting the misinformation. This could be because subjects who took longer to make a response analyzed the new information with a more critical eye, and made them more likely to reject the misinformation. By contrast, subjects who did accept the misinformation did not take long to make a decision, suggesting the possibility that they did not examine the new information very critically. These results could be interpreted to suggest that the more uncritically new information is accepted, the more likely it will be incorporated into the pre-existing memory and later recalled as being something the individual saw with his or her own eyes. Information examined with a critical eye towards where it came from and how it compares to memory of genuinely perceived events is less likely to be so incorporated. In forensics, hypnosis has been a technique used to aid eyewitnesses in recalling what they saw. A survey conducted by Yapko [15] demonstrated that a great many mental health professionals believe hypnosis has an enhancing effect on memory. Given the fact that hypnosis induces an altered state of consciousness, however, how resistant are individuals under hypnosis to possible misinformation? How critically can they examine new information?

A study performed by Sheehan, Grigg, and McCann [16] subjected 92 volunteers to a slide series that showed a man surreptitiously stealing a wallet from a woman. The subjects were then either placed under hypnosis or instructed to simulate being under

hypnosis. A new investigator, blind to the condition the subjects were in, then came in and asked a series of open-ended questions designed to plant misinformation (for example, suggesting during the course of the question that the robber had the name "Nixon" written on his jacket when in fact he did not). After the subjects were brought out of hypnosis (or pretended to come out), they were administered a forced-choice recognition test that included the false items planted in the hypnosis/simulation condition.

While both groups ended up incorporating the misleading information into their recognition responses, the hypnosis group did so more frequently. In addition, the hypnosis group intruded more objects and actions into their free-recall accounts that were not actually present or did not occur. Sheehan et al. interpret these results to mean that hypnosis lowers the degree to which an individual scrutinizes a piece of information for accuracy. Such an individual is more likely to accept information uncritically as accurate, and consequently incorporate it into his or her memory.

The potential mechanism for such an action was labeled "absorption" by Tellegen [17], who defined it as intense concentration on a central experience at the expense of contextual orientation. In other words, because the individual keeps all of his or her attention on the central experience (i.e., listening to the hypnotist), new information being introduced lacks the kind of perceptual and contextual specificity that allows the subject to identify it as such. Consequently, the ability of a person to engage in source or reality monitoring may be seriously impaired by the hypnotic state. Even a basic source memory can be lost, such as in hypnotic source amnesia [18], where an individual under hypnosis mistakes an external instruction as coming from him or herself. The implications for testimony "refreshed" by hypnosis, or of memories elicited through hypnotic suggestion,

are obvious. Any question that contained even the smallest bit of information could potentially develop into a full-fledged memory, a memory that the subject would be impaired in evaluating as to its veracity.

Reality Monitoring and Repressed Memory Syndrome

The controversy surrounding hypnosis and its possible effects on memory has not stopped it from being used as a technique in memory recovery. Therapists may use hypnosis and make suggestions to their patients that conceivably could be interpreted by the patients as originating in their own thoughts or recollections. But is it really plausible that a person could accept a wholly fabricated impression as being a genuine memory? One interesting additional finding related to the qualitative differences between perceived and imagined events was reported by Johnson, Foley, Suengas, and Raye [19] in their study of autobiographical memory. They asked subjects to generate memories of old and new perceived events, as well as old and new imagined events. For example, a subject would be asked to recall a trip to the dentist as a perceived event. They would also be asked to remember something that they always wanted to do but never did, as an imagined event. Johnson et al. [19] found that the older perceived memories tended to have less perceptual detail than the newer perceived memories. These old memories also had fewer contextual underpinnings, such as where the subject was, what time of day it was, and what happened just before and after the main event. One possible explanation for these differences would be that as memories age, they lose some of their perceptual richness. In addition, the sense of how the memory fits into the larger context of the person's life fades away, leaving the memory isolated from what happened before and after the event in question. The end result may be that as perceived memories age, they

approach imagined memories in how they "seem" qualitatively, with relatively few perceptual details and contextual links.

Why, then, is this important? Such a view is important because it makes the phenomenon of false memory syndrome more understandable, and more amenable to scientific study. There is an almost stereotypical scenario surrounding the recovery of repressed memories. An individual enters therapy for some problem, and becomes convinced, either through popular literature or through the therapist, that his or her real problem stems from abuse that occurred in childhood but is now repressed. The individual works to "recover" memories of this abuse, perhaps through hypnosis or another technique like guided imagery. Once an individual accepts that there is at least the possibility that they could have been abused, however, they may accept their imagery as memory. From a qualitative standpoint, what they have imagined could seem quite similar to other, genuine memories of childhood.

An easy riposte to such a speculation is that the emotional component has been left out. Individuals would not be able to fabricate memories that contained genuine emotional content. Loftus [20], however, was able to demonstrate that individuals could be led to believe in fabricated events that contained at least a moderately traumatic impact. She approached relatives of a number of people and asked them to bring up a memory of when the subjects got lost in a shopping mall – an event that never actually occurred. While most of the people reacted with confusion when first hearing of the event, they eventually came to believe it actually happened, to the extent that some spontaneously filled in details of the situation that their relatives never mentioned. Nearly all remembered it as an upsetting experience. Loftus was able to show, in an

admittedly anecdotal way, that it was possible to create memories with genuine emotional content when encouraged by a person the subjects knew well and trusted, a situation not unlike the therapy experience. Of course, ethical considerations prevented her from attempting to create the kind of traumatic memories and emotions that would arise from being physically or sexually abused.

"Pretend You Didn't Hear That" – Directed Forgetting

In discussing memory distortion, another phenomenon worthy of mention is the "Directed Forgetting" effect. A typical paradigm [21] is when subjects are given a list of words to remember. The experimental group is then told that the list they just remembered was merely practice, and that they should forget it. They are then given a second list of words to remember. The control group is given the second list without the instructions to forget the first. Both groups are then instructed to recall all the words that they can. The experimental group is specifically cued to recall words they were previously told to forget, lest the subjects simply choose not to recall words from the first list as a demand characteristic of the experiment. The directed forgetting effect is found when the experimental group recalls fewer words from the first list than the control group.

Several theories have been put forth to explain directed forgetting, including differential encoding, differential storage, and selective rehearsal [22]. Whetstone, Cross, and Whetstone [23] suggested that the directed forgetting effect is due to initiation of an unconscious process that determines what will later enter consciousness. In a study utilizing event-related brain potentials, Ullsperger, Meckilnger, and Muller [22] noted that in a recognition task conducted after the initial words were presented, the

presentation of to-be-remembered words evoked potentials in both the frontal and parietal lobes, while presentation of to-be-forgotten words evoked potentials in only the frontal lobe. In contrast, a different experiment designed to prompt differential encoding (the subjects were instructed to process words either shallowly or deeply) showed both frontal and parietal ERPs. The investigators reported that the results suggested that directed forgetting involved active inhibition of the to-be-forgotten words.

The notion of a process that controls forgetting runs contrary to previously accepted theory, in that forgetting is due merely to an absence of active encoding strategies, or insufficient attention being allocated. In the case of such phenomena as repressed memory, the idea is compelling, and begs the question of whether "repressed" memory is in fact due to the person telling himself or herself to forget what happened to them. It is important to point out that directed forgetting does not appear to wipe the memory clean. When subjects are given recognition, as opposed to recall tasks, the directed forgetting effect disappears [21]. This effect may be analogous to anecdotal stories told by individuals who claim to suffer from repressed memory, and who indicate that they had no recollection of their abuse until some particular smell, sound, or visual cue triggered their recall. The directed forgetting effect is further evidence that human beings are not passive recorders of information, and that many different processes may occur to alter, inhibit, or enhance memory.

Stealing History: The Story of Binjamin Wilkomirski

> My earliest memories are a rubble field of isolated images and events. Shards of memory with hard knife-sharp edges, which still cut flesh if touched today. Mostly a chaotic jumble, with very little chronological fit; shards that keep surfacing against the orderly grain of grown-up life and escaping the laws of logic.

> If I'm going to write about it, I have to give up on the ordering logic of grown-ups; it would only distort what happened…I can only use words to draw as exactly as possible what happened, what I saw; exactly the way my child's memory has held on to it; with no benefit of perspective or vanishing point. [24]

Perhaps the most puzzling and compelling single case of memory distortion is the case of Binjamin Wilkomirski. In 1995, Wilkomirski published a book called *Fragments*, which he indicated was an account of his experiences as a young child who grew up in Riga, Latvia, and survived stays in 2 concentration camps during the Holocaust. He was eventually smuggled into Switzerland, where he was raised by the Doesekkers, a doctor and his wife. *Fragments* proved to be an international sensation, and was eventually translated into 9 languages. Wilkomirski himself became a figure of some note, and traveled to various countries lecturing about his book and meeting fellow Holocaust survivors. During one such visit to the United States, he met a woman by the name of Laura Grabowski, who was herself a Holocaust survivor. While Grabowski did not immediately recognize him, Wilkomirski remembered Grabowski as another child he knew at the Birkinau concentration camp, and showed her a picture from a Krakow orphanage where they were both pictured. During a concert on National Holocaust Remembrance Day in 1998, Wilkomirski told the audience about the first time he saw Grabowski at Birkinau:

> I saw that someone was brought back to the barrack, I was sitting in the mud, and then I thought I was the last of the children. And then I was very happy when I saw that the door of our barrack opened and two girls of our group came out holding hands. And I looked at them and that's why I kept it in my memory. I was very much astonished, I thought: Why had one girl's hair turned white? The other girl was normal blond. [25]

During this same concert, Wilkomirski and Grabowski played a duet on the piano, which was filmed by the BBC for a television special. It was a very dramatic and affecting scene.

And, as it turns out, nearly all of it was false. Wilkomirski's fame took an unexpected turn in 1998, when a journalist named Daniel Ganzfried published a story challenging his identity as a Holocaust survivor [25]. He indicated that Wilkomirski was actually Bruno Grosjean, born in Switzerland in 1941, and eventually adopted by a childless couple in 1945. He was not a Jew from Riga, and in fact had never left neutral Switzerland during the Second World War. And Laura Grabowksi? It was later discovered that she was actually a woman by the name of Laurel Rose Willson, born in Tacoma, Washington in 1941. Her major claim to fame, before her association with Wilkomirski, was her publication (as Lauren Stratford) of a book called *Satan's Underground*, where she claimed to be a victim of satanic ritual abuse [25].

If Wilkomirski were simply a fraud, *Fragments* would go on the list of notable literary hoaxes, alongside the Hitler diaries. What makes his case so unusual, is that he genuinely seems to believe that he was there. Despite the charges against him, back up by ample government documents showing Grosjean's birth to a single mother, his numerous foster placements, and his eventual adoption by the Doesekker family, Wilkomirski has continued to insist that he is a Holocaust survivor. Wilkomirksi's case demonstrates just how far memory distortion can extend, to where an individual has been able to craft an entirely fictional history for himself.

Flashbulb Memories

The phenomenon of false repressed memory, and of cases like that of Binjamin Wilkomirski, suggests that it is possible to fabricate memories of very traumatic events and believe them to be real. What, then, about genuine emotional or traumatic events that are experienced? Are they encoded differently than "everyday" memories? From an intuitive point of view, it would seem that emotional events tend to stand out in our lives, particularly more than mundane, day-to-day events. Perhaps, then, emotion has an enhancing effect on memory, giving emotionally laden memories vividness than causes them to stand out. One of the defining events for the United States occurred on November 22, 1963, when John F. Kennedy was assassinated in Dallas, Texas. It was a moment that seemed to sear itself into the nation's consciousness. For years afterward, people would be able to tell you, in great detail, where they were and what they were doing when they first heard that Kennedy had been shot. Brown and Kulick [26], writing about this and other similar phenomena, theorized that a special mechanism triggered by the extreme emotionality of the event essentially froze the moment in time. They dubbed such memories "flashbulb" memories, because they appeared to have the clarity of a photograph.

Memory researchers were eager to put Brown and Kulick's theory to the test. With each new national trauma, it seemed, came investigators canvassing college campuses and other places to record individuals' recollections of their personal situation when they heard of the event. Then the investigators could contact the subjects months down the road and ask them to recount their stories again, comparing them to the old recollections to test for accuracy. When President Reagan was shot by John Hinckley in

1981, Pillemer [27] interviewed subjects one month, and then seven months, after the event. He found that personal recollections were richly detailed and quite consistent between the two time periods. He also found that people who responded with stronger initial emotions had more elaborate and more consistent memories. Pillemer's results would seem to bear out Brown and Kulick's theory. However, his interpretations are weakened somewhat by the fact that he first interviewed his subjects a month after the event. Their recollections could have been influenced by talking to others about the event over that time frame. The closer the first interview to the event itself, the more accurate the initial memory will be, allowing for a better idea of how stable such memories remain over time.

Neisser and Harsch [28] were able to interview subjects the day after the space shuttle Challenger exploded on live national television as it lifted off from the Florida peninsula in January, 1986. They then waited for 2 1/2 years before interviewing their subjects again. What they found was that about a third of the 44 students had recollections that were in fact very inconsistent with their initial recollections, while not one had a recollection entirely consistent. In addition, the students were frequently very surprised when confronted with their initial recollections; their memories seemed so vivid. Neisser, who first wrote a critique of the "flashbulb" theory in 1982, used this study to suggest that the phenomenon was more mythical than real.

A somewhat less harsh response to Brown and Kulick was by Christianson [29], a Swedish psychologist. He interviewed 40 subjects 6 weeks and again one year after the Swedish Prime Minister, Olaf Palme, was assassinated. Christianson found that the initial recollections contained a high level of detail concerning the individuals' personal

circumstances surrounding their first hearing of the event, suggesting to Christianson that the memories were good examples of "flashbulb" memories. However, the memories recalled a year later contained significantly fewer details, suggesting a certain amount of forgetting over that time period.

According to Christianson [29], the study suggested that like most memories, flashbulb memories consisted of recall of the gist, or central aspects of the event, followed by reconstruction of specific details. It is possible that since the gist is recalled with particular vividness, any reconstruction done around the core takes on that same feeling of clarity, leading to the sometimes wildly inaccurate recollections found by Neisser and Harsch that nevertheless seem so real. Take, for example, the following account from their 1992 study:

> When I first heard about the explosion I was sitting in my freshman dorm room with my roommate and we were watching TV. It came on a news flash and we were both totally shocked. I was really upset and I went upstairs to talk to a friend of mine and then I called my parents [28]

This recollection, taken two and a half years after the Challenger explosion, seems very vivid. The student's initial recollection, however, had her first hearing the news in class, then going home and getting the details from television -- presumably alone, since no roommate was mentioned in the first account, nor was there a call to her parents mentioned. What happened to the memory? Christianson [29] hypothesized that reconstructions, in the absence of specific recalled details, will be based on what is "typical" for the individual. For example, the above student, remembering clearly that she first heard the news in the morning, may have inferred that she received it through a typical morning activity -- watching TV with her roommate. Another possibility could be

that the student heard so many people talk about seeing the explosion on television that she adopted their stories as her own, a failure of source monitoring. These naturalistic studies of memory are certainly fascinating, but in the absence of more specific information about what individuals actually encode and why, all we can do is speculate about how emotion actually influences memory. What, then, do more controlled experiments tell us?

Emotion in the Laboratory

Experimenters have done studies that expose subjects to emotionally laden stimuli, with the aim of seeing how such stimuli are encoded and remembered. Loftus and Christianson [30] conducted a study by which subjects were shown a series of 15 slides. Each slide depicted some everyday scene (a kitchen, a sidewalk, etc.). Each slide had some central feature placed clearly in the foreground, and a peripheral feature placed in the background. The critical slide was number 8, which depicted a woman with a bicycle. This slide was varied for 3 different groups. To elicit an emotional response, one version had the woman lying beside a bicycle, bleeding from the head. Another, neutral version simply showed the woman riding the bicycle, which was shown to the control group. A third variation showed the woman carrying the bicycle over her head. This variation was presented to a third group in order to determine what effect surprising or unusual events had on memory.

After the subjects viewed the slides, they were shown another series of slides that were identical to the original slides except that the central and peripheral features had been removed. They were then asked to indicate what features had been removed and describe them, including perceptual features (e.g., the color of a coat). Finally, subjects

were given a recognition test where they were presented with four versions of a given slide and asked to pick which one they had previously seen. The results indicated that, compared to the control group, the emotion group had better memory for central details, but impaired memory for peripheral details. By contrast, the group shown the unusual slide demonstrated impaired memory for both central and peripheral details. These results suggest that, aside from the novelty of the item, there was something about the emotional nature of the "accident" slide that improved memory for the central details.

In order to determine the nature of this effect, Loftus and Christianson exposed another set of groups to the slides and asked them to write down what they first thought about when viewing each slide. Qualitative analysis of the responses indicated that the emotional group tended to be more specific about the central figure (by referring to her gender more frequently), and made frequent reference to the central action. They were also more likely to report some affect. By contrast, the neutral group was more likely to contain descriptions of the surrounding environment. The unusual group was like the emotion group in that it made fewer comments about the surrounding environment, but unlike the emotion group in that their productions contained fewer affective comments.

In comparing the comments made by the subjects to the previous experiment, it would seem that the differing content of the critical slides contributed to a differential focus of attention on central vs. peripheral details. The emotion group appeared to focus in on the central figure, while the neutral group apparently shifted between the figure and the figure's surroundings (Loftus and Christianson admit that in the absence of a tachistoscope or other method to track the persons' movements, there is no way to be sure of this). This is consistent with the results showing better memory for central details but

impaired memory for peripheral details when the slide contains emotional content. While the unusual group also appeared to focus in on the central figure, their lack of an affective response may have contributed to a degraded encoding of memory. Loftus and Christianson theorized that one possibility for the unusual group's results could be that they were focused in on some aspect of the slide not tested.

Another, similar study of the effect of emotional content on memory processing was conducted by Burke, Heuer, and Reisberg [31]. In this study, there were two basic sets of slides produced that showed a mother taking her son to visit his father at work (a spoken narrative accompanied the slide presentation). One set showed the mother taking her son to a garage, where he watched his father work on a car. Another set, the emotional set, showed the mother taking the son to a hospital, where he watched his father perform a graphic surgical procedure. There were a total of 12 slides per group, with the first set and last set (taking the son to, then away the place of work) being identical between groups. Burke et al. tested the emotional impact of the slides by monitoring heart rate, and showed that the group shown the surgery slides demonstrated more physiological arousal than the group shown the garage slides. Interestingly enough, the researches found that the heart rate of subjects viewing the surgery slides actually *slowed*. While this might seem to be counterintuitive, Burke et al. note that previous research has shown that cardiac deceleration has been associated with *increased* cortical arousal [31]. In testing memory, they divided the content of the slides into four categories: gist (the main thrust of the story), basic-level visual information (a brief description of the slide in question), central details (plot-irrelevant details spatially near a

central figure or action) and peripheral details (plot-irrelevant details spatially removed from a central figure or action).

The subjects were given multiple-choice questions for each type of memory content one week after the initial viewing. The results indicated better memory for gist and basic-level visual information across the slide series in subjects who viewed the surgery slides. For central details, those slides that specifically held the arousing stimuli (the surgery) demonstrated a marked enhancement of memory. By contrast, memory for peripheral details in the slides containing emotional content was impaired. These results are consistent with those of Loftus and Christianson [30]. These studies suggest that emotionally arousing stimuli lead to a narrowing of attention on the central aspect of those stimuli, at the expense of peripheral information. One notable example of such a phenomenon occurring in everyday life is the phenomenon of "gun focus," explained by Loftus [32] as the tendency of victims of muggings or holdups to focus inordinately on the weapon being trained on them. The result is a highly detailed description of the weapon itself, with only a vague sense of the person who happened to be holding it. The narrowing of attention has been demonstrated in animal studies as well. Wurtz, Goldberg, and Robinson [33] demonstrated by using a tachistoscope that monkeys presented with a neutral monkey face will train their eyes all around the face. However, when presented with a "threat" face (eyes and mouth wide open), the monkeys will focus in on the eyes and mouth, failing to take in the entire face as before.

The previous studies have strongly suggested that a narrowing of attention on central details occurs during emotional events. A natural conclusion would be that the enhanced memory for central details is due to the additional attentional resources devoted

to the central aspects of the stimulus at the encoding stage. However, studies of memory that manipulate brain chemistry have demonstrated that modulating affect after learning has already occurred still affects memory. For example, the adrenal medullary hormone epinephrine is commonly released during stressful experiences. Experiments in which epinephrine was administered to rats after passive-avoidance training demonstrated improved retention for the training [34]. Looking at the other side of the issue, McGaugh [35] administered propranolol (a beta-adrenergic antagonist) to human subjects prior to their watching a slide series similar to the one used by Burke, Heuer, and Reisberg [31]. The medicated group did not show the emotion-enhancing effects normally seen upon viewing the emotional slides. Of course, since the propranolol was administered prior to viewing the slides, the lack of an effect for emotional content could be due to loss of the attentional narrowing effect.

Hypotheses

The narrowing effect that emotional content can have on an individual's attention raises the question of what occurs when individuals are asked to reconstruct emotional events. Will they be able to discern that they did not really pay much attention to peripheral details? Will they be more susceptible to accepting misinformation, as in hypnosis? Will they be more likely to make errors of source or reality monitoring? The current study was designed to answer these questions. The study showed subjects a videotaped vignette of a man and a woman having a discussion. One group was shown a vignette with low emotional content that has the couple discussing neutral (non-emotional) issues for a set amount of time in several rooms of a house. A second group was shown an emotional vignette that was perceptually similar to the neutral scene,

except that the couple was arguing about a more emotional, personal topic. Halfway through the scene, the man suddenly appeared to slap the woman. There were many details to see in the house; some were peripheral to the action, (i.e., spatially removed from the central characters) and some were central to the action (e.g., spatially close to the center of the scene). There were also details directly associated with the persons in the vignettes (i.e., clothing and jewelry).

After the subjects viewed the various scenes, they were given a written test of memory for the scene. Based on the method used by Zaragoza and Lane [12], some subjects took a test that asked questions about the scene in such a way that suggested the existence of certain items that were not actually seen. Other subjects took a similar test that did not include misinformation. After this test, the subjects were given a recognition test for a variety of items. Some of these items were present in the scene, and some were not. There were also items that were suggested to be present by the interposed test (that is, the test that was given to those subjects in the misinformation conditions). Subjects in the misinformation conditions who responded positively to an item suggested were considered to have accepted the misinformation.

Based on previous research, the following hypotheses were made:

- In the condition without misinformation, subjects who view an emotional scene will have enhanced memory for central details and impaired memory for peripheral details compared to subjects who view a neutral scene.
- In the condition with misinformation, subjects who view an emotional scene will be more likely to accept misinformation related to peripheral items, and less likely

to accept misinformation related to central items, compared to subjects who view a neutral scene.

Capturing "Emotional Memory" – An Unbreakable Conundrum?

Before continuing on to the procedure section, it is worthwhile to consider a methodological issue that is peculiar to this field of study. To measure the effect of emotion on memory, the researcher makes 2 key assumptions: that his or her method will be successful in evoking an emotional response, and that any change between the control group and the experimental group is the result of that emotion. The first assumption can be checked in any number of ways: by self-report, measuring heart rate, or other physiological signs of arousal (again, assuming that an emotional response will produce such changes in the sympathetic nervous system). The researcher should be able to determine that at the very least, an emotional reaction has been produced.

The second assumption, that it is the emotional response that produces the change in recall or recognition, is more problematic. In order to provoke the emotional response to begin with, changes must necessarily be made to the stimuli that will be used. If one is presenting a stimulus that is designed to provoke an emotional response in the subject, that stimulus must be of a qualitatively different nature than a stimulus that is not intended to provoke such a response. For example, a researcher wishing to provoke an emotional response as part of the experimental method may do so by showing the subject a picture of a dead kitten. The researcher might wish to show a photograph to the control subject as well. Assuming the researcher does not want to provoke an emotional response in the control group, he or she most likely would not show the same photo. By making such changes in stimuli between the control and experimental groups, a confound

is thus introduced into the system. After all, the true variable is not the different photographs, but rather the different emotional response (or lack thereof) that the photos produce.

When changes are indeed seen in memory, the researcher is thus faced with the question of what really caused the change. Was it the different emotional state the subjects experienced? Or was it the differences between the physical stimuli themselves? If the researcher is studying the effect of emotion on memory, he or she would undoubtedly prefer to believe that it was the emotional component that produced the change. The difference between the stimuli themselves, however, can never be completely discounted. Burke, Heuer, & Reisberg [31] considered that one solution would be using the same stimuli for the control and emotional groups, and then manipulating arousal through some external means. One could, for example, have one group of subjects watch the stimuli while sitting next to a fearful object. Burke et al [31] argued, however, that there is reason to believe that a qualitative difference exists between remembering an emotional event, and remembering a neutral event while emotional. In other words, the researcher may have solved the methodological problem, but in the process has failed to capture the very process that is of interest.

Burke et al [31] discussed one alternative that was presented in an unpublished thesis by K. Andrews [36]. Andrews tested memory for emotional and neutral scenes from a number of successful movies that had been viewed 6 months previously. He also asked subjects to rate how "arousable" they were, by rating such things as how long they stay angry after a fight. Andrews found that the subjects who rated themselves as being more arousable had a memory advantage for emotional scenes from the selected films.

This result suggested that subjects who had a greater emotional reaction to such scenes had improved memory for them. Burke et al [31] concluded that although the confound of differences between stimuli cannot be discounted, "the accumulation of evidence does justify speaking in terms of *emotion's* memory effects."

CHAPTER 2
METHOD

Subjects

100 undergraduate students from the University of Florida were recruited from the Introductory Psychology class and offered course credit in return for participation. The study was approved by the Health Science Center IRB (IRB-01), and all subjects executed a written consent form prior to participating.

Equipment

The vignettes were recorded using a Panasonic DV-710 digital camcorder, which was connected to a Sanyo ProEx Multimedia Projector for viewing. The vignettes were projected onto a standard white movie screen, yielding a viewing area approximately 5 feet in width and height. The recognition test items were recorded and played on an audiocassette recorder. Still frames of each scene are presented in Figures 1, 2, and 3.

Design

Subjects were randomly assigned to one of four groups, making for a total of 25 subjects in each group. The demographic characteristics of each group are listed in Table 1. Each subject was run in 3 phases: watching the vignette, taking a True / False test, then taking a recognition test.

The experiment had two between-subjects conditions. The first condition was which vignette (neutral or emotional) the subjects viewed. Each vignette was

Table 1: Demographic Characteristics of Each Group (Entire Subject Pool)

		# of Males	# of Females	Average Age (in years)
Misinformation	Emotional	6	19	18.68
	Neutral	6	19	18.92
No Misinf.	Emotional	6	19	19.96
	Neutral	7	18	18.68

Figure 1: Scene Number One

Figure 2: Scene Number Two

Figure 3: Scene Number Three

approximately the same length (4 minutes long). They were each split into 3 separate scenes. The first and second scenes each lasted approximately 1½ minutes, while the third scene lasted a little over a minute. The neutral vignette consisted of a man and a woman discussing their day and plans for the weekend. The emotional vignette consisted of the same man and woman arguing about their possible exposure to AIDS, with the man striking the woman midway through the vignette. In every other respect (clothing, camera angle, etc.) the vignettes were identical. Minor differences in lighting were present, due to the fact that the emotional and neutral vignettes were filmed on 2 different days.

The second condition was which written test the subject received before the recognition test (misinformation or no misinformation). The misinformation test asked True / False questions about the vignettes in such a way as to suggest the existence of details that were not actually present. For example, one question was "In the first scene, the man glanced at his wristwatch." In fact, he was not wearing a watch. The no misinformation test asked the same questions without the misinformation. To continue the above example, the no-misinformation question read "In the first scene, the man glanced at his wrist." Both the misinformation and no misinformation conditions asked subjects to rate the vignette as to how emotional they felt after viewing it, using a 1-10 scale. They were also asked how interesting they thought it was, and how well they thought they remembered it (again using a 10-point scale). Each group received the same recognition test. The test consisted of a voice saying a series of items (for example "Number one -- candlestick, number two -- coffee machine, number three -- red sweater," and so forth). There were 3 types of items: items present on the tape, items suggested through misinformation, and items neither present nor suggested.

The items present or suggested were classified as central items, peripheral items , or person-centered items. Person-centered items consisted of items worn by the actors. They were treated differently from the other items, as these items were present in all 3 scenes. All other items were either present in only one scene, or suggested as being present in only one scene. Each scene was composed with the actors facing each other, the camera being placed roughly perpendicular to their sight line (see Figures 1-3). With respect to items actually present, "central" items were classified as such based on the fact that they were in between the two actors, close to the spatial center of the screen.

"Peripheral" items were classified as such based on them being close to the left or right edge of the screen.

With each condition, the design is as follows:

		Written Test	
		Misinformation	No Misinformation
	Low emotion	25	25
Vignette:			
	High emotion	25	25

Procedure

Subjects were run in groups of 4 to 8, depending on how many enrolled for a given time. Subjects were seated equidistantly from a movie screen, each with an unimpeded view. They received the following instructions: "This is a test of memory. I want you to watch the following tape carefully." The subjects then watched the appropriate vignette. After watching the vignette, each subject was given a brief questionnaire about the vignette, asking them to rate the vignette on how emotional they thought it was, how interesting they thought it was, and how well they thought they remembered it. They were then given the State-Trait Anxiety Inventory (STAI), a measure that assesses both acute and chronic symptoms of anxiety. Finally, they were given the True / False questionnaire. Ten minutes from the end of the vignette, the tests were collected and a new sheet was handed out with numbered blank spaces. The subjects were instructed as follows: "The last part of the experiment today is another test

of memory. You will be listening to a voice on this tape machine. The voice will say a number of different items. Some of these items were on the tape you saw earlier, and other items were not. I want you to listen to each item and write down 'yes' if you remember seeing it on the tape and 'no' if you do not remember seeing it." After the subjects completed the test and their papers were collected, they were given the opportunity to be debriefed as to the true purpose of the study.

Data Analysis

Recognition test. On the recognition test, there were several different types of items: There were genuine items, indicating items that were actually present in the vignette. These were divided into central, peripheral, and person-centered items. There were suggested items, indicating items that were not present in the vignette, but were suggested to be present. These were divided into central (suggested), peripheral (suggested), and person-centered (suggested) items. Finally, there were spoiler items that were neither present nor suggested. Since the no-misinformation groups did not have items suggested to them, the central and peripheral suggested items were treated as spoilers as well. For genuine items, the number of hits (correct recognition of the item) was recorded. For suggested items, the number of "hits" was recorded for subjects in the Misinformation conditions. For spoilers, the number of false alarms was recorded.

Statistical analysis included an ANOVA done on hits for both misinformation and no misinformation groups. Group (misinformation vs. no-misinformation) and Vignette (emotional vs. neutral) were between-subjects variables, and item type (central vs. peripheral) and scene (one vs. two vs. three) were within-subjects variables:

		Group	
		Misinformation	No misinformation
Vignette	Neutral	# hits(c)/# hits(p)	# hits(c)/# hits(p)
	Emotional	# hits(c)/# hits(p)	# hits(c)/# hits(p)

Planned comparisons using the Bonferroni method were made between those subjects who viewed the neutral tape, and those subjects who viewed the emotional tape. Only those subjects who did not receive misinformation were included in the planned comparison. This made for 6 planned comparisons: 1 comparison between Emotional and Neutral subjects for each Location x Scene group mean (Peripheral items in Scene 1, Central items in Scene 1, etc). The family wise error rate was set at $p = 0.1$ for this set of comparisons. Another ANOVA was conducted with hits on person-centered items as the dependent variable. These items were considered separately from the other hits, as they were present in all 3 scenes (as opposed to the peripheral and central items, which were each present in only one scene). An additional ANOVA was conducted on misinformation items. Only the subjects in the Misinformation conditions were included in this ANOVA. Vignette Type (emotional v. neutral) served as a between-subjects factor, and Location (central v. peripheral v. personal) and Scene (1 v. 2 v. 3) were within-subjects factors. Planned comparisons using the Bonferroni method were made between Emotional and Neutral Subjects for each Location x Scene group mean. This made for 9 planned comparisons. The family wise error rate was set at $p = 0.1$ for this set of comparisons. Finally, an ANOVA was conducted on the false alarm rate, with

Vignette Type (emotional v. neutral) and Misinformation Condition (misinformation v. no misinformation) as between-subjects factors.

Story data. In addition to the recognition test, data was collected on the True / False test subjects took prior to taking the recognition test. Six questions were selected, which were the same across all conditions. These questions each considered a specific action in a specific scene, asking whether the action took place or not. Two questions for each scene were selected. The subjects' responses to each question (accurate or inaccurate) were recorded. An ANOVA was conducted with Vignette Type and Misinformation Condition as between-subjects factors, and Question (1 through 6) as the within-subjects factor.

CHAPTER 3
RESULTS

Entire Dataset

Hypothesis 1

The first hypothesis suggested that in the condition without misinformation, subjects who view an emotional scene would have enhanced memory for central details and impaired memory for peripheral details compared to subjects who view a neutral scene. To test for this, planned comparisons were made on the "Hits" data for subjects in the No Misinformation condition, between the Emotional and Neutral subjects for each Location (central vs. peripheral) x Scene (1 vs. 2 vs. 3) group mean. These planned comparisons showed no differences between the Emotional and Neutral subjects for each Location x Scene mean. Thus, the first hypothesis was not supported.

Hypothesis 2

The second hypothesis suggested that in the condition with misinformation, subjects who view an emotional scene would be more likely to accept misinformation related to peripheral items, and less likely to accept misinformation related to central items, compared to subjects who view a neutral scene. To test for this, planned comparisons were made on the Misinformation data for subjects in the Misinformation condition, between the Emotional and Neutral subjects for each Location (central vs. peripheral vs. person-centered) x Scene (1 vs. 2 vs. 3) group mean. These planned

comparisons showed no differences between the Emotional and Neutral subjects for each Location x Scene mean. Thus, the second hypothesis was not supported.

Exploratory Analyses

Self-report rating. T-tests were conducted on the self-report variables of Memory (how well the subject thought he or she remembered the vignette), Emotion (how emotional the subject found the tape to be), and Interest (how interesting the subject found the tape to be), with the Vignette Type (Emotional v. Neutral) as the grouping factor. Since all subjects made their self-report ratings before receiving the True / False test that established which Misinformation condition they were in, subjects in each Emotion condition were collapsed across the two levels of Misinformation. Results of the t-test comparing memory for the Emotional and Neutral conditions was not significant [$T(98) = 1.642$, $p = .104$], indicating that the subjects rated their memory for the vignettes about the same, regardless of whether they viewed the emotional or neutral vignette. The t-test for Emotion was significant [$T(98) = 10.022$, $p < .001$]. As expected, subjects who viewed the emotional vignette rated it as being more emotional than subjects who viewed the neutral vignette. The t-test for Interest was also significant [$T(98) = 7.678$, $p < .001$], indicating that subjects who viewed the emotional vignette rated it as being more interesting than subjects who viewed the neutral vignette. T-tests on the STAI data were also run, with Vignette Type (Emotional v. Neutral) as the grouping factor. The t-tests for both the State scale [$T(98) = -.820$, $p = .414$] and Trait scale [$T(98) = .055$, $p = .956$] were not significant. Means and standard deviations for these self-report ratings are presented in Table 2.

Table 2: Means and Standard Deviations for Self-Report Ratings and STAI Scores (Entire Subject Pool)

	Self-Report Ratings			STAI Scores	
Vignette Type	Memory	Emotion	Interest	State	Trait
Emotional	7.86 (1.43)	5.76 (2.31)	5.6 (2.13)	31.6 (8.3)	37.9 (9.3)
Neutral	7.44 (1.11)	2.22 (0.95)	2.6 (1.76)	33.0 (9.5)	37.9 (8.9)

Hits. A 2 (Vignette Type; Emotional, Neutral) x 2 (Misinformation Condition; Misinformation, No Misinformation) x 3 (Scene; 1,2,3) x 2 (Location; Central, Peripheral) repeated measures ANOVA was conducted on hits (items from the recognition test correctly recognized as being present in the vignettes). The means for these variables are presented in Table 3.

Table 3: Mean values and standard deviations for correct recognition of peripheral and central items, presented for each condition (Entire Subject Pool)

Item Type		Peripheral			Central		
Scene		1	2	3	1	2	3
Misinformation	Emotional	.96 (.539)	.72 (.737)	1.12 (.781)	1.08 (.493)	1.24 (.663)	1.16 (.473)
	Neutral	.84 (.746)	.6 (.645)	.88 (.666)	.88 (.666)	1.2 (.707)	1.08 (.277)
No Misinf.	Emotional	1.04 (.611)	.68 (.690)	1.16 (.850)	1.12 (.526)	1.16 (.8)	1.04 (.2)
	Neutral	.72 (.614)	.64 (.7)	1.36 (.757)	1.08 (.64)	.88 (.726)	1.08 (.493)

Note: For each cell, there are a total of two items that may be recognized. So perfect recognition for all subjects for a certain cell would result in a mean value of 2.0 for that cell.

There was a significant main effect for Location [$F(1, 96) = 5.415$, $p < .001$], indicating that recognition of central items was superior to recognition of peripheral items. There

was also a main effect for Scene [F (2, 192) = 5.736, p < .005], demonstrating that recognition for items from the 3rd scene in the vignette was superior to recognition of items presented in the previous scenes. The polynomial test of order for scene was significant [F (1, 96) = 4.868, p < .05], indicating a significant linear trend in hits (with recognition improving for each subsequent scene). Finally, there was a significant Location x Scene interaction [F (2, 192)= 8.944, p < .001]. This interaction is presented in Figure 4. The separate ANOVA conducted on the person-centered items showed no significant effects or interactions.

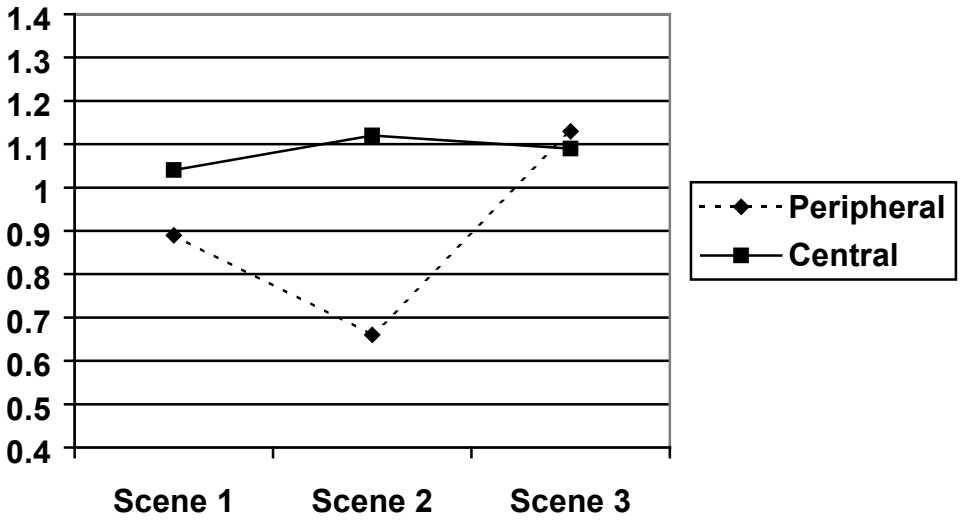

Figure 4 – Mean values for correct recognition of peripheral and central cues (Entire Subject Pool)

False alarms. A 2 (Vignette Type; Emotional, Neutral) x 2 (Misinformation Condition; Misinformation, No Misinformation) ANOVA was conducted on the false alarm rate (calculated by dividing the number of false alarms by the total number of spoilers present). The ANOVA revealed no significant effects or interactions.

Table 4: Mean values for False Alarms and Person-Centered Items, presented for each condition (Entire Subject Pool)

		False Alarm Rate	Person-Centered Items
Misinformation	Emotional	10.8%	2.2 (.913)
	Neutral	12.4%	2.08 (.759)
No Misinf.	Emotional	11.3%	2.36 (.757)
	Neutral	13.3%	2.2 (.707)

Misinformation. A 2 (Vignette Type; Emotional, Neutral) x 3 (Scene; 1, 2, 3) x 3 (Location; Suggested Peripheral v. Suggested Central v. Suggested Personal) repeated measures ANOVA was conducted for Misinformation items, using the subjects who participated in the Misinformation conditions. The means for these variables are presented in Table 5. There was only one significant result, a Location x Scene interaction [$F(4, 192) = 16.577$, $p < .001$]. There were no significant interactions with Vignette Type.

Table 5: Mean values and standard deviations for acceptance of suggested peripheral, central, and personal items, presented for each Misinformation condition (Entire Subject Pool)

Item Type		Peripheral			Central			Personal		
Scene		1	2	3	1	2	3	1	2	3
Misinf.	Em.	.4 (.5)	.56 (.507)	.44 (.507)	.28 (.458)	.52 (.51)	.24 (.436)	.68 (.476)	.12 (.332)	.48 (.507)
	Neut.	.36 (.49)	.4 (.5)	.52 (.51)	.12 (.332)	.52 (.51)	.32 (.476)	.68 (.476)	.20 (.408)	.4 (.5)

Note: For each cell, there is one suggested item. Therefore, each value may also be read as a percentage. For example, the value ".4" may also be read that 40% of the subjects in that condition "recognized" the suggested item.

Figure 5, comparing the averages of all misinformation conditions across all 4 between-subjects groups clearly demonstrates that subjects in the misinformation condition endorsed the misinformation items with greater frequency than subjects in the no misinformation condition.

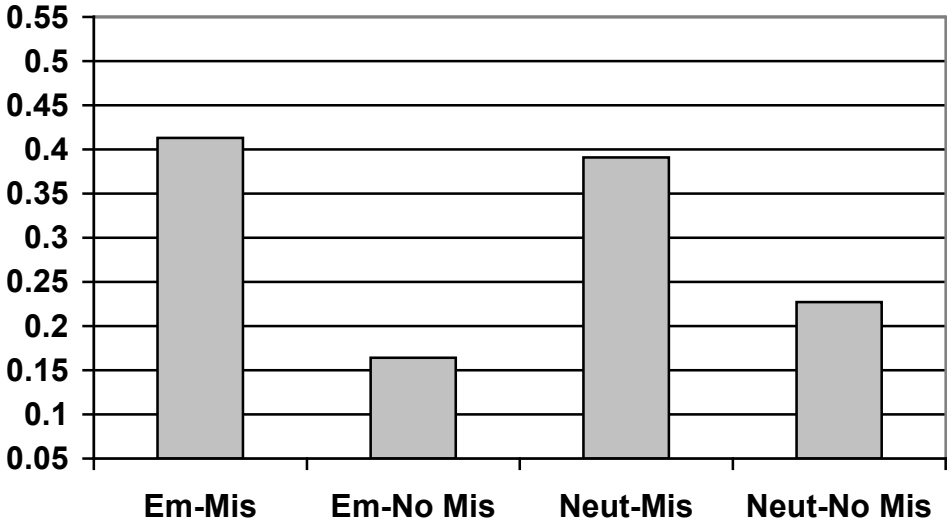

Figure 5 – Mean values for endorsement of misinformation items (Entire Subject Pool)

Story data. A 2 (Vignette Type; Emotional, Neutral) x 2 (Misinformation Condition; Misinformation, No Misinformation) x 6 (Question; 1-6) repeated measures ANOVA was conducted on subjects' accuracy on 6 items taken from the True / False test that sampled various behaviors occurring during the vignettes. Question (1-6) was the within-subjects factor. The means for these variables are presented in Table 6.

There was a significant main effect for Question [$F(5, 480) = 18.350$, $p < .001$]. The main effect for Misinformation approached significance [$F(1, 96) = 2.934$, $p = .090$]. There was a significant Vignette Type x Question interaction [$F(5, 480) = 5.985$, $p. < .001$]. This interaction is presented in Figure 6. It shows that subjects who viewed the emotional vignette had poorer accuracy for questions that concerned the opening scene.

Table 6: Mean values for correct responses to 6 True / False items, presented for each condition (Entire Subject Pool)

		Question 1	Question 2	Question 3	Question 4	Question 5	Question 6
Misinformation	Emotional	.52	.4	.88	.88	.88	.68
	Neutral	1.0	.64	.76	.8	.8	.52
No Misinf.	Emotional	.72	.44	1.0	.92	.88	.68
	Neutral	.96	.52	.92	.96	.92	.52

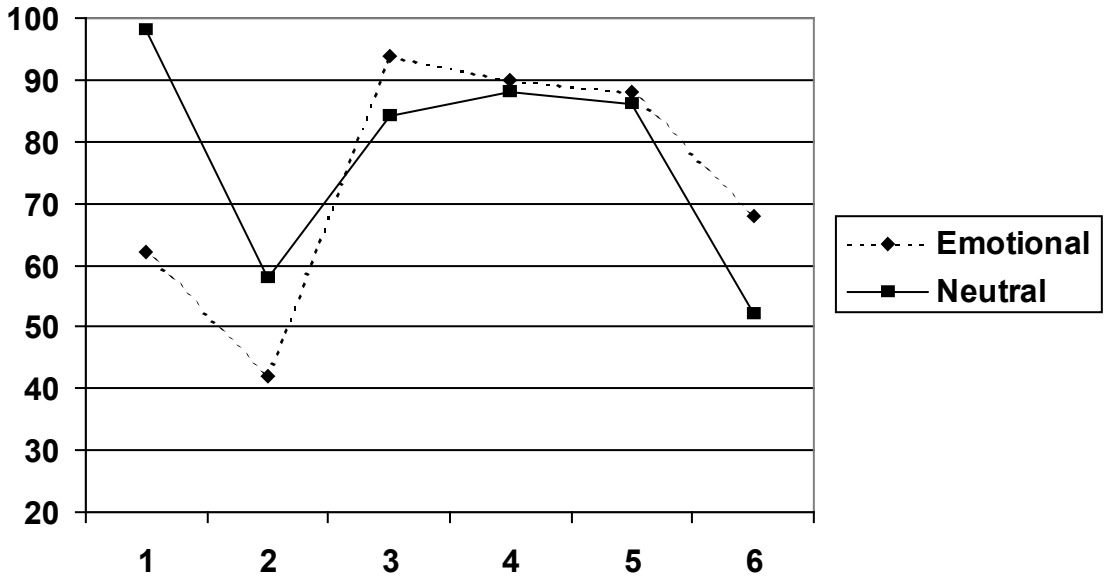

Figure 6 – Accuracy rate for selected True / False questions, split by Vignette Type (Entire Subject Pool)

Comparing the Emotional Subjects

The initial analyses on the Emotion factor revealed significant variability among subjects in their rating of the vignettes. While it was true that as a whole subjects who viewed the Emotion Vignette rated the tape as more emotional than those who viewed the Neutral Vignette, there was more variability in their ratings than expected. Several

subjects who viewed the emotional vignette simply did not find it emotional. There was some concern that their performance would be closer to those who viewed the neutral vignettes, and consequently would dilute or otherwise negate the responses of those who did in fact find the tape emotional. Consequently, it was decided on a *post hoc* basis to split the emotional subjects into two groups: those who rated the vignette a "5" or less on emotionality, and those who rated the vignette a "6" or higher on this variable. The new groups were labeled the "Low Emotion" group, and the "High Emotion" group. The "Low Emotion" group yielded 12 subjects in the misinformation condition, and 9 subjects in the no misinformation condition. This left the "High Emotion" group with 13 subjects in the misinformation condition, and 16 subjects in the no misinformation condition. Of interest was whether the "Low" vs. "High" group variable (labeled "Emotion Level" in the analyses) proved a significant factor in the performance of the subjects. Subjects who viewed the neutral vignette were not included in this set of analyses.

Self-report ratings. Means for self-report ratings for each condition are presented in Table 7.

Table 7: Means and Standard Deviations for Self-Report Ratings and STAI Scores (Emotional Subjects)

	Self-Report Ratings			STAI Scores	
Group	Memory	Emotion	Interest	State	Trait
Low Emotional	7.57 (1.89)	3.48 (1.29)	4.1 (1.55)	31.3 (9.1)	36.8 (9.0)
High Emotional	8.01 (0.96)	7.41 (1.18)	6.69 (1.82)	31.8 (7.8)	38.9 (9.5)

The t-test for Memory was not significant [T (48)= -1.109, p = .277], indicating that the subjects in the "Low" and "High" groups rated their memory for the vignettes about the

same. Not surprisingly, the t-test for the Emotion self-report variable was significant [T (48) = -11.04, p < .001]. The t-test for the Interest self-report variable was also significant [T (48) = -5.441, p < .001], demonstrating that those subjects who rated the vignette as being more emotional also tended to find it more interesting. T-tests on the STAI data were also run, with Emotion Level (High Emotional v. Low Emotional) as the grouping factor. The t-tests for both the State scale [T (48) = -.211, p = .834] and Trait scale [T (48) = -.786, p = .436] were not significant.

Hits. A 2 (Emotion Level; Emotional, Neutral) x 2 (Misinformation Condition; Misinformation, No Misinformation) x 3 (Scene; 1, 2, 3) x 2 (Location; Peripheral, Central) repeated measures ANOVA was conducted on the data from subjects viewing the emotional vignette. Means for these variables are presented in Table 8.

Table 8: Mean values and standard deviations for correct recognition of peripheral and central items, presented for each condition (Emotional Subjects)

Item Type		Peripheral			Central		
Scene		1	2	3	1	2	3
Misinformation	Low Em.	1.0 (.603)	.5 (.522)	1.33 (.778)	1.17 (.577)	1.0 (.739)	1.08 (.515)
	High Em.	.92 (.494)	.92 (.862)	.92 (.760)	1.0 (.408)	1.46 (1.46)	1.23 (.439)
No Misinf.	Low Em.	1.22 (.441)	1.0 (.707)	.78 (.833)	1.22 (.441)	1.56 (.726)	1.11 (.33)
	High Em.	.94 (.68)	.5 (.632)	1.38 (.806)	1.06 (.574)	.94 (.772)	1.0 (0.0)

Note: For each cell, there are a total of two items that may be recognized. So perfect recognition for all subjects for a certain cell would result in a mean value of 2.0 for that cell.

There was a significant Scene x Misinformation x Emotion Level interaction [F (2, 92) = 8.349, p < .001). This interaction is presented in Figure 7, and demonstrates that, for subjects in the no misinformation condition, higher ratings of stimulus emotionality led to inferior recognition of items presented in the second scene.

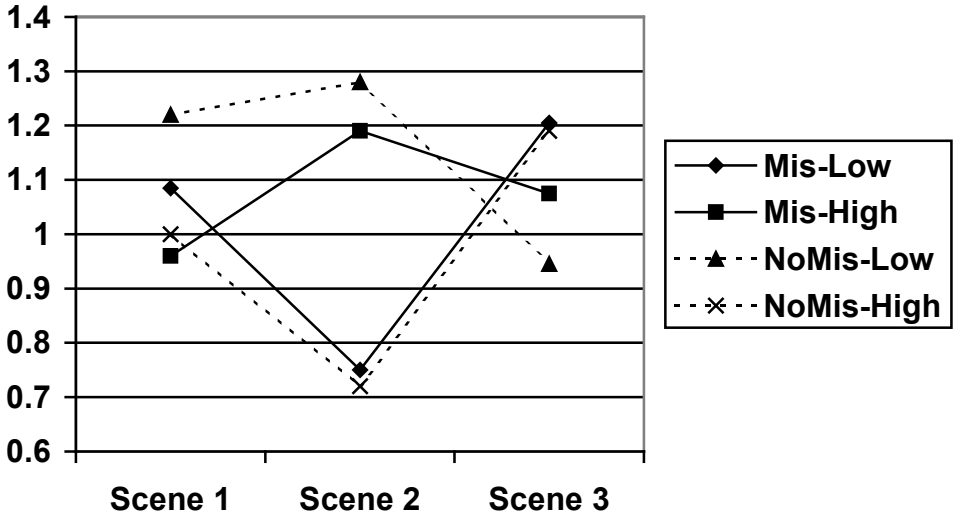

Figure 7 – Mean values for correct recognition of items in each scene, by Misinformation Condition and Emlevel (Emotional Subjects)

However, for subjects who did receive misinformation about the vignette higher emotionality ratings led to superior recognition for items presented in the second scene. There was also a significant location x scene interaction [F (2, 92) = 4.367, p < .05], indicating that recognition for peripheral items in the second scene was poorer than recognition of central items. This interaction is similar to the same interaction shown with the entire subject pool. There was a significant main effect for Location [F (1, 46) = 13.15, p = .001]. A separate ANOVA conducted on person-centered items revealed no significant effects or interactions.

False alarms. An ANOVA was conducted on the false alarm rate, with Emotion Level and Misinformation Condition serving as between-subjects factors. No significant effects or interactions were observed.

Table 9: Mean values and standard deviations for False Alarms and Person-Centered Items, presented for each condition (Emotional Subjects)

		False Alarm Rate	Person-Centered Items
Misinformation	Low Em.	12.5%	2.17 (.835)
	High Em.	9.4%	2.23 (1.01)
No Misinf.	Low Em.	11.5%	2.22 (.972)
	High Em.	11.1%	2.44 (.629)

Misinformation. A 2 (Emotion Level; High Emotion, Low Emotion) x 3 (Scene; 1, 2, 3) x 3 (Location; suggested central v. suggested peripheral v. suggested personal) repeated measures ANOVA was conducted for Misinformation items as within-subjects factors. The means for these variables are presented in Table 10.

Table 10: Mean values and standard deviations for acceptance of suggested peripheral, central, and personal items, presented for each Misinformation condition (Emotional Subjects)

Item Type		Peripheral			Central			Personal		
Scene		1	2	3	1	2	3	1	2	3
Misinf.	Low Em.	.42 (.515)	.42 (.515)	.33 (.492)	.25 (.452)	.5 (.522)	.33 (.492)	.67 (.492)	.25 (.452)	.42 (.515)
	High Em.	.38 (.506)	.69 (.480)	.54 (.519)	.31 (.480)	.54 (.519)	.15 (.376)	.69 (.480)	.0 (0.0)	.54 (.519)

Note: For each cell, there is one suggested item. Therefore, each value may also be read as a percentage. For example, the value ".4" may also be read that 40% of the subjects in that condition "recognized" the suggested item.

There was a significant Location x Scene interaction [$F(4, 92) = 7.616$, $p < .01$].

Story data. A 2 (Emotion Level; High Emotional, Low Emotional) x 2 (Misinformation; Misinformation, No Misinformation) x 6 (Question; 1-6) repeated measures ANOVA was conducted on the 6 True / False items that sampled behavior at various points during the vignettes. The means for these variables are presented in Table 11. There was a significant main effect for Question [$F(1, 48) = 13.950$, $p < .001$].

Table 11: Mean values for correct responses to 6 True / False items, presented for each condition (Emotional Subjects)

		Question 1	Question 2	Question 3	Question 4	Question 5	Question 6
Misinformation	Low Em.	.58	.5	.92	.92	.92	.58
	High Em.	.46	.31	.85	.85	.85	.77
No Misinf.	Low Em.	.67	.33	1.0	1.0	1.0	.67
	High Em.	.75	.5	1.0	.88	.81	.69

Reduced Dataset

The splitting of the emotional subjects into two groups and comparing them demonstrated that those subjects who rated the vignettes as more emotional produced significantly different responses than those who rated the vignettes as less emotional. It was decided then to rerun the analyses, this time comparing the subjects who viewed the neutral vignette only to those subjects who viewed the emotional vignette and who rated it a “6” or higher on the Emotion scale. This reduced the subjects in the “Emotional-

Misinformation" condition from 25 to 13, and reduced the subjects in the "Emotional-No Misinformation" condition from 25 to 16. There were no changes to subjects in the Neutral conditions.

Hypothesis 1

The first hypothesis was tested for in the same manner for the reduced dataset as it was for the entire dataset, in that planned comparisons were made on the "Hits" data for subjects in the No Misinformation condition, between the Emotional and Neutral subjects for each Location (central vs. peripheral) x Scene (1 vs. 2 vs. 3) group mean. These planned comparisons showed no differences between the Emotional and Neutral subjects for each Location x Scene mean. Thus, the first hypothesis was again not supported.

Hypothesis 2

The second hypothesis was tested for in the same manner for the reduced dataset as it was for the entire dataset, in that planned comparisons were made on the Misinformation data for subjects in the Misinformation condition, between the Emotional and Neutral subjects for each Location (central vs. peripheral vs. person-centered) x Scene (1 vs. 2 vs. 3) group mean. Planned comparisons between subjects in each Vignette Type condition yielded a close to significant difference between Emotional and Neutral subjects for the suggested peripheral item in Scene 2 [$F(1, 144) = 5.324$], where the critical value for F was 6.64. This difference is shown in Figure 9, and suggests that subjects who viewed the emotional vignette were more likely to accept misinformation for a peripheral item in the second scene, than subjects who viewed the neutral vignette.

Exploratory Analyses

Self-report ratings. Means for self-report ratings for each condition are presented in Table 12.

Table 12: Means and Standard Deviations for Self-Report Ratings (Reduced Subject Pool)

	Self-Report Ratings			STAI Scores	
Vig. Type	Memory	Emotion	Interest	State	Trait
Emotional	8.07 (0.96)	7.41 (1.18)	6.69 (1.82)	31.8 (7.8)	38.9 (9.5)
Neutral	7.44 (1.11)	2.22 (0.95)	2.6 (1.76)	33.0 (9.5)	37.9 (8.9)

The t-test for the Memory self-report variable was significant [T (77) = 2.547, p < .05), indicating that subjects who viewed the emotional vignette reported greater confidence in their memory for the vignette than those who viewed the neutral vignette. The t-tests for the Emotion and Interest self-report variables were also significant [T (77) = 21.353, p < .000; T (77) = 9.760, p < .000, respectively), indicating that those subjects who viewed the emotional vignette rated it as both more emotional and more interesting than the neutral vignette. T-tests on the STAI data were also run, with Vignette Type (Emotional v. Neutral) as the grouping factor. The t-tests for both the State scale [T (77) = -.601, p = .550] and Trait scale [T (77) = .462, p = .646] were not significant.

Hits. A 2 (Vignette Type; Emotional, Neutral) x 2 (Misinformation; Misinformation, No Misinformation) x 3 (Scene; 1, 2, 3) x 2 (Location; Peripheral, Central) repeated measures ANOVA was conducted on the reduced data set. Data for this analysis are presented in Table 13. There was a significant location x scene x Misinformation interaction [F (2, 150) = 3.886, p < .05]. This interaction is presented in

Table 13: Mean values for correct recognition of peripheral and central items, presented for each condition (Reduced Subject Pool)

Item Type		Peripheral			Central		
Scene		1	2	3	1	2	3
Misinformation	Emotional	.92 (.494)	.92 (.862)	.92 (.760)	1.0 (.408)	1.46 (.519)	1.23 (.439)
	Neutral	.84 (.746)	.6 (.645)	.88 (.667)	.88 (.667)	1.2 (.707)	1.08 (.277)
No Misinf.	Emotional	.94 (.68)	.5 (.632)	1.38 (.806)	1.06 (.574)	.94 (.772)	1.0 (0.0)
	Neutral	.72 (.614)	.64 (.7)	1.36 (.757)	1.08 (.64)	.88 (.726)	1.08 (.493)

Note: For each cell, there are a total of two items that may be recognized. So perfect recognition for all subjects for a certain cell would result in a mean value of 2.0 for that cell.

Figure 8. Three significant two-way interactions were found. There was a Scene x Misinformation interaction [$F(2, 150) = 5.239$, $p < .01$], indicating that subjects who did not receive misinformation had poorer recognition for items in scene 2, but better recognition for items in scene 3. There was a Location x Misinformation interaction [$F(1,75) = 4.34$, $p < .05$], indicating that subjects who received misinformation had better recognition for central then peripheral items, and better recognition for central items than subjects who did not receive misinformation. There was a Location x Scene interaction [$F(2, 150) = 6.496$, $p < .01$], indicating that subjects had poorer recognition for peripheral items from scene 2. There was a significant main effect for Location [$F(1, 75)= 14.193$, $p < .01$), indicating that subjects had better recognition for central than peripheral items. There was also a significant main effect for Scene [$F(2, 150) = 4.851$, $p < .01$], demonstrating that recognition for items from the 3rd scene in the vignette was superior to

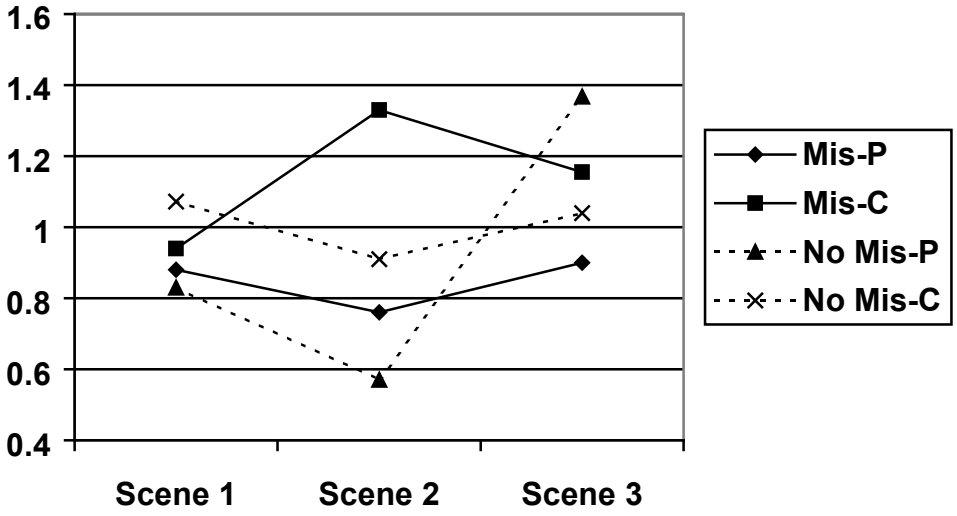

Figure 8—Mean values for correct recognition of peripheral and central items, split by Misinformation Condition (Reduced Subject Pool)

recognition of items presented in the previous scenes. The separate ANOVA conducted on person-centered items revealed no significant effects or interactions.

False alarms. An ANOVA was conducted on the false alarm rate, with Vignette Type and Misinformation Condition serving as between-subjects factors. No significant effects or interactions were observed.

Table 14: Mean values and standard deviations for False Alarms and Person-Centered Items, presented for each condition (Reduced Subject Pool)

		False Alarm Rate	Person-Centered Items
Misinformation	Emotional	9.4%	2.23 (1.01)
	Neutral	12.4%	2.08 (.759)
No Misinf.	Emotional	11.1%	2.44 (.629)
	Neutral	13.3%	2.2 (.707)

Misinformation. A 2 (Vignette; Emotional, Neutral) x 3 (Scene; 1, 2, 3) x 3 (Location; suggested central, suggested peripheral, suggested personal) repeated measures ANOVA was conducted for Misinformation items. The data for this analysis are presented in Table 15.

Table 15: Mean values for acceptance of suggested peripheral, central, and personal items, presented for each Misinformation condition (Reduced Subject Pool)

Item Type		Peripheral			Central			Personal		
Scene		1	2	3	1	2	3	1	2	3
Misinf.	Em.	.38 (.506)	.69 (.480)	.54 (.519)	.31 (.480)	.54 (.519)	.15 (.376)	.69 (.480)	.0 (0.0)	.54 (.519)
	Neut.	.36 (.49)	.4 (.5)	.52 (.51)	.12 (.332)	.52 (.51)	.32 (.476)	.68 (.476)	.20 (.408)	.4 (.5)

Note: For each cell, there is one suggested item. Therefore, each value may also be read as a percentage. For example, the value ".4" may also be read that 40% of the subjects in that condition "recognized" the suggested item.

There was a significant Location x Scene X Vignette Type interaction [$F(4, 144) = 2.553$, $p < .05$]. This interaction is presented in Figures 9, 10, and 11. The interaction suggests that subjects who watched the emotional vignette were more likely to accept misinformation that a peripheral item was present in the second scene. There was also a significant Location x Scene interaction [$F(4, 144) = 16.135$, $p < .001$]. The main effect for Location approached significance [$F(2, 72) = 2.889$, $p = .068$].

Story data. A 2 (Vignette; Emotional, Neutral) x 2 (Misinformation; Misinformation, No Misinformation) x 6 (Question; 1-6) repeated measures ANOVA was conducted on the 6 True / False items that sampled behavior at various points during the vignettes. The data for this analysis are presented in Table 16.

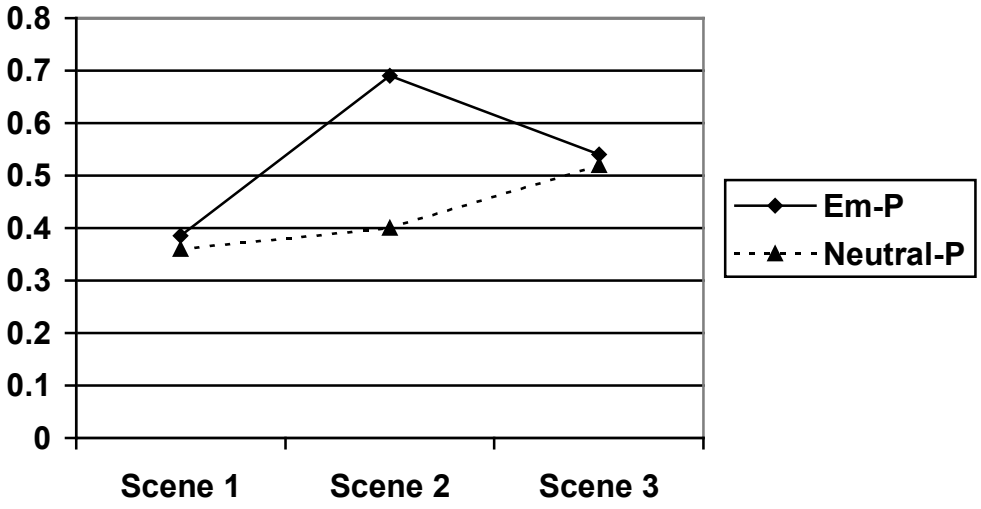

Figure 9—Mean values for suggested peripheral items later "recognized" by subjects in the Misinformation Condition, split by Vignette Type (Reduced Subject Pool)

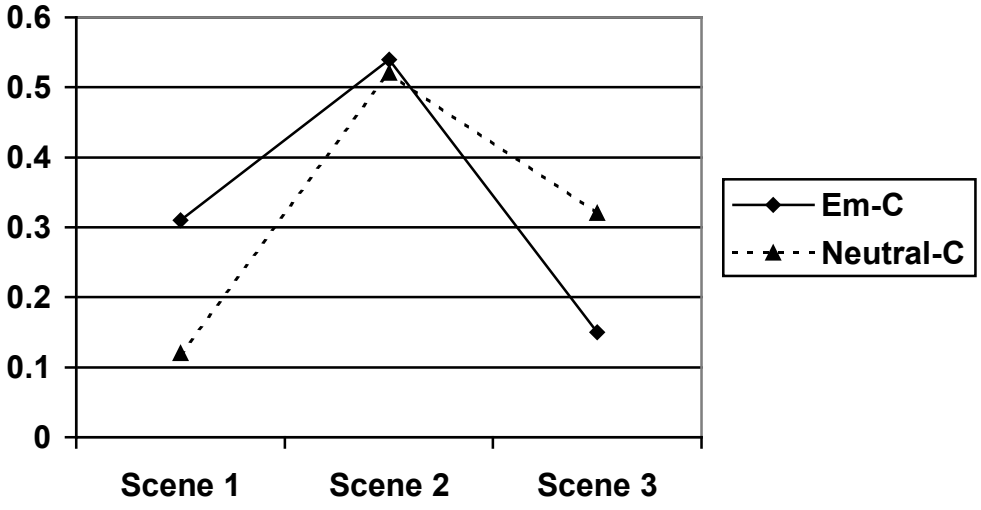

Figure 10—Mean values for suggested central items later "recognized" by subjects in the Misinformation Condition, split by Vignette Type (Reduced Subject Pool)

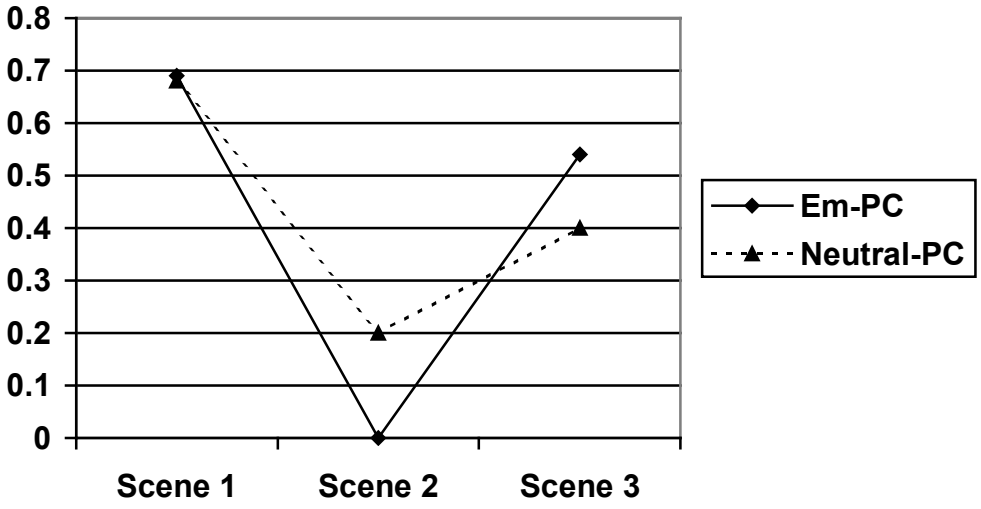

Figure 11—Mean values for suggested person-centered items later "recognized" by subjects in the Misinformation Condition, split by Vignette Type (Reduced Subject Pool)

Table 16: Mean values for correct responses to 6 True / False items, presented for each condition (Reduced Subject Pool)

		Question 1	Question 2	Question 3	Question 4	Question 5	Question 6
Misinformation	Emotional	.46	.31	.85	.85	.85	.77
	Neutral	1.0	.64	.76	.8	.8	.52
No Misinf.	Emotional	.75	.5	1.0	.88	.81	.69
	Neutral	.96	.52	.92	.96	.92	.52

There was a significant Question x Vignette Type interaction [$F(5, 375) = 4.806$, $p < .001$], indicating that subjects who viewed the emotional vignette had poorer accuracy for questions that concerned the opening scene. The main effect for Question [$F(5, 375) = 11.620$, $p < .001$] was significant, and the main effect for Misinformation Condition approached significance [$F(1, 75) = 3.305$, $p = .073$].

CHAPTER 4
DISCUSSION

Self-Report Data

The subjects' self report responses to the vignettes were as expected, in that those who viewed the emotional vignette tended to rate it as being more emotional and more interesting than those who viewed the neutral vignette. One result that was somewhat unexpected was the relatively low group mean for the subjects viewing the emotional vignette, regarding how emotional they found the vignette to be. This result, combined with the relatively high variability within the group for this variable, did not prevent the emotional group's overall score from being significantly higher than the neutral group's score. It does demonstrate that, within the emotional group, there were those who found the tape to be quite emotional, and those who found the tape to not be very emotional at all.

One important aspect of this research is that it is the individual's personal response to an event, not the "nominal" emotional category to which an event belongs, that influences subsequent memory for the event. Consequently, the variability in rated emotion within the subjects who viewed the emotional vignette could potentially reflect significant variability regarding their later performance on the memory tasks. Indeed, when the emotional group was split into 2 groups depending on the self-report rating for

emotion, the 2 groups were found to have different performance patterns on recognition for objects from the vignette. The nature of this difference will be discussed later.

In a way, the high variability in emotion self-report scores should not have been that surprising. When the study conducted by Andrews [36] addressed the concept of "arousability," it was addressing the notion that some subjects would be more likely to become emotional in response to a scene than others. The results of this study indicated that subjects' ratings of how arousable they were interacted with how well they remembered emotional scenes. The chain of implications is as follows: subjects who are more arousable are more likely to become emotional (or, perhaps, become more emotional) in response to a specific scene. Those subjects who become emotional then have a memory advantage for such scenes. One could postulate that those subjects who rated the "emotion" vignette as being more emotional would have rated themselves as being more arousable, should they have been given the same measure that Andrews [36] used.

The gathering of this self-report data has 2 important uses for the experimenter. First, such data allow the experimenter to account for a significant source of variability in the data. Second, such data provide a means to control for the stimuli-difference confound discussed earlier. When comparing subjects who view emotional v. neutral vignettes, there is a confound when attempting to hypothesize the source of any group differences. Those differences could be due to a difference in emotionality, but there are significant stimuli differences that could also potentially account for the differences. Although Burke, Heuer, & Reisberg [31] argued that the preponderance of evidence argues that such differences can be attributed to the effects of emotion, they also agree

that differences in stimuli cannot simply be ignored. In the case of differing degrees of emotionality, the subjects have viewed the same stimuli; they simply have differing levels of emotional response to it. Consequently, any group differences observed can be attributed to the effects of emotion with more certainty. In this respect, it was fortuitous that self-report data were gathered for the present experiment. However, because the data were gathered *after* the subjects were exposed to the stimulus, there is the danger of falling into circular reasoning regarding how such data is to be interpreted. This will be discussed later.

One other result of interest regarding the self-report data is the nearly identical ratings between groups regarding how well they believed that they remembered the vignettes. It is important to note that this rating was taken before the subjects were asked to recall or recognize anything about the vignettes. In future studies, it would be useful to ask the subjects to rate their memory for the vignettes both before and after they complete the recall and recognition tests. The post-test rating would be roughly equivalent to previous studies that rated the confidence with which subjects reported what they remembered.

"Hits" Data

One hypothesis for the present study was that subjects who viewed the emotional vignette would have superior recognition for central items, and inferior recognition for peripheral items, compared to subjects who viewed the neutral vignette. This hypothesis was not supported by the results. The Vignette Type factor (Emotional v. Neutral) did not interact significantly with any of the "hits" variables in the design for either the entire

subject pool or the reduced subject pool, indicating that the vignette the subjects watched was not a factor in how well they recognized items that were present in the vignette.

In the comparison made of subjects in the Emotion Condition, split by how emotional they found the vignette to be, there is evidence that emotion played some role in subject's memory for actual items presented in the vignette. The interaction presented in Figure 3 demonstrates that, for subjects in the no misinformation condition, higher ratings of stimulus emotionality led to inferior recognition of items presented in the second scene. However, for subjects who did receive misinformation about the vignette higher emotionality ratings led to *superior* recognition for items presented in the second scene.

This unexpected interaction indicates that exposure to misinformation may affect the ability to accurately recognize items that were actually present in the vignettes. The fact that misinformation has such an impact is further borne out by the Location x Scene x Misinformation interaction generated by the reduced subject pool (see Figure 4). There has been speculation by researchers regarding the effect of misinformation on original memory. Hypotheses have ranged from misinformation taking the place of the original memory, to misinformation making the retrieval of original memories more difficult [12]. However, these hypotheses have usually involved an attempt to mislead a subject that one item that they saw was actually another. For example, Loftus, Feldman, & Dashiell [37] discussed an experiment where subjects saw a slide of a woman handling a hammer. They were later misled to believe that the woman was actually holding a screwdriver. In this example, the misinformation was explicitly designed to interfere with the original

memory of the hammer. The present experiment demonstrates that misinformation affected the subjects' recognition of totally unrelated objects.

Another way that misinformation may affect recognition of genuine items is the phenomenon of retroactive interference. Schacter [38] provided a brief overview of this phenomenon, a basic example being that once a subject has learned one word pair, learning a second pair will interfere with his ability to recall the first pair. This explanation would suggest that subjects exposed to misinformation would have poorer recognition for genuine items across the board. The nature of the interaction presented in Figure 3, however, suggests that misinformation actually *improves* recognition for items in certain circumstances.

The reconstructive nature of memory may provide an explanation for the suggestion that misinformation improves recognition in some situations, and impairs recognition in others. If a question that involves planting misinformation causes the subject to reconstruct a memory in order to answer the question, that reconstruction may alter other aspects of the subject's recollection. For example, one True / False question that attempts to plant misinformation reads: "In the second scene, the radio below the center table was switched on." A subject, after reading this question, may reconstruct a memory of the second scene in order to determine if a radio was under the center table. This reconstruction may involve the retrieval of other items on or around the center table, which could potentially improve the subject's recognition of those items later on. Another question reads: "The mail on the couch in the second scene had been opened." This question may lead a subject to reconstruct a memory of the couch in order to determine if there was mail on the couch. This reconstruction would most likely not

include the flag that is behind the couch, as it is not spatially close to the area of interest. Thus, a subject focused on reconstructing a memory of the couch may have poorer recognition for the flag, because his reconstructed memory has been focused on the couch area. An analysis of Figure 4 reveals that, in the second scene, those subjects who received misinformation had improved recognition for genuine central items compared to subjects who did not receive misinformation. By contrast, subjects who received misinformation did not have improved recognition for genuine peripheral items.

Figure 4 also shows that subjects who did receive misinformation had poorer recognition for peripheral items in the third scene, compared to subjects who did not receive misinformation. The question regarding peripheral misinformation for the third scene was: "In the third scene, the bag of chips in the right corner had been opened." In this instance, the scene is framed in such a way that there is very little space on the right side between the refrigerator and the edge of the frame, and this space is occupied by a teapot—one of the genuine peripheral items (see Picture 3). Consequently, a subject receiving the misinformation may, in reconstructing the scene, replace the teapot with a bag of chips, resulting in impaired recognition for the teapot later on.

In any event, there is insufficient control in the present study to conclusively determine just how the misinformation condition interacts with subjects' recognition of genuine items. A future study may, through careful placement of items in the vignettes, provide a better understanding of how being exposed to misinformation affects subjects' memory processes.

Story Data

With respect to the story recall data, it is particularly important to consider the potential impact of the confound between vignette differences and emotionality. Figure 2 shows a significant difference between subjects who viewed the emotional tape versus the subjects who viewed the neutral tape, with the emotional group having much poorer accuracy for the first question. It is tempting to simply ascribe this difference to the emotion factor and to conclude that subjects viewing the emotional tape were not paying attention to elements of the story in the first scene and consequently had poorer accuracy for questions about that scene. It is worthwhile, however, to examine the question itself and how what it samples may be different across the two vignettes. The question reads: "In the first scene, the man touched the woman's knee." In the neutral vignette, the man touched the woman's knee as if he were brushing something off of it. In the emotional scene, he touched her knee as an effort at reconciliation. However, in the emotional scene the woman jerked her knee away very quickly. This could potentially lead subjects viewing this vignette to believe that the man *attempted* to touch the woman's knee, but did not actually do so. Significantly, this possible misperception is not necessarily related to the emotional content of the scene. As such, it cannot be concluded that the difference between the emotional and neutral groups is due to the differing level of emotionality. In future studies, it will be important to ensure that any such details remain as identical as possible across vignettes.

Misinformation Data

The second hypothesis of the present study was that, in the misinformation condition, subjects who viewed the emotional vignette would be more likely to accept

misinformation regarding peripheral items (that is, a suggestion that an item was present on the periphery of the image), and less likely to accept misinformation regarding central items, than subjects who viewed the neutral vignette. With respect to the reduced dataset, this hypothesis was partially supported. The significant interaction that was generated suggests that subjects who viewed the emotional vignette and rated it as being more emotional were more likely to accept misinformation regarding peripheral items, but this only appeared to be the case when it regarded the second scene. It is important to note that the planned comparisons only yielded a close to significant result for this comparison, and as such it should be interpreted with caution. It is perhaps significant that this scene contained the critical element in which the man appeared to slap the woman in the emotional vignette. There was no difference, however, between the emotional and neutral subjects with respect to acceptance of misinformation about central items or person-centered items. In other words, subjects who viewed the emotion vignette were *not* less likely to accept misinformation regarding central items. This part of the hypothesis was not supported.

The results of the analysis of misinformation data show that it was not difficult to get subjects to "recognize" items that were merely suggested to them. For the most part, however, there were no significant differences between subjects who viewed the emotional vignette and subjects who viewed the neutral vignette. The close to significant difference between emotional and neutral subjects in the second scene for peripheral cues could be due to the fact that a particularly emotional event occurred in the second scene. It could be that it took such a potent event to produce the "narrowing" effect hypothesized by researchers such as Burke, Heuer, & Reisberg [31].

In discussing the second scene, it is important to note that many of the interactions noted revolve around differences that exist in that scene, compared to the first and third scenes. It is most likely not a coincidence that the most distinctive event in all the vignettes, the slap, occurs in the second scene. One argument, just noted, is that the slap that occurs in the second scene produced a narrowing of attention. This argument presupposes that it is the emotional element of the event that produces the narrowing of attention, and thus produces the differences in recognition and misinformation acceptance. Another phenomenon that may potentially explain the interactions that revolve around this scene is the von Restorff effect [39]. One example of this effect is asking subjects to memorize a string of letters, which have a number in the middle (e.g. qwer7tyui). The effect is found when subjects have greater recall for the number, which stands out in the middle of the string, than for the letters. It should be noted that this effect is based on distinctiveness and novelty, rather than emotionality.

In the context of the present study, the von Restorff effect would demonstrate itself based on memory for the event of the slap, versus memory of other behaviors performed by the actors in the vignettes. Unfortunately, memory for the slap itself was not sampled, in part because it only occurred in the emotional vignette. One way that this could have been dealt with would be to have a question in the True/False test that sampled behavior connected with the slap, which also occurred in the neutral scene. For example, in both vignettes the man stood up in the middle of the second scene; in the emotional scene to slap the woman, and in the neutral scene to ostensibly wave away an insect. This behavior could have been sampled, with the expectation that recognition for

it would be better for subjects who viewed the emotional vignette, versus subjects who viewed the neutral vignette.

Presuming for a moment that the von Restorff effect exists in the present study, linking it to the resulting interactions would require an understanding of how a novel and distinctive stimulus affects recall or recognition of other elements in the scene. In the study conducted by Loftus and Christianson [30], they placed just such a distinctive event in the critical slide in 2 of the 3 conditions. In one, the distinctive event could be said to have an emotionally charged component, in that a woman was shown lying beside a bicycle, suggesting that she had been in an accident. In another, the woman was shown carrying the bicycle over her head. You will recall that the group shown the "accident" slide had improved memory for details central to the action (such as the color of the woman's coat), and impaired memory for peripheral details, compared to a group that was shown the woman riding the bicycle. By contrast, the group shown the slide where the woman is carrying the bicycle demonstrated impaired memory for both central and peripheral details. These results suggest that novel and distinctive events can have an inhibitory effect on memory. However, under certain circumstances subjects will have enhanced memory for details immediately surrounding the main action. Loftus and Christianson suggested that it was the emotional component of the stimulus that provided the differential recognition of central versus peripheral details.

Limitations and Future Directions

The present study has several methodological limitations that inhibit full understanding of the results that have been generated. This section will outline these

limitations and attempt to provide solutions that would make follow-up studies more productive.

Individual differences. One major limitation of the present study is the lack of individual differences data. While the study collected data on subjects' personal reactions to the taped vignettes, no information was gathered regarding individual differences that existed *prior* to exposure to the stimulus. Why is this important? In the present study, the emotional subjects were split into 2 groups on the basis of their self-report regarding how emotional they found the stimulus. In using such a distinction to define the subjects, a circular argument is created. For example, in discussing the results of comparing the "high" emotion subjects with the "low" emotion subjects, it was hypothesized that the differences noted were due to differences in how emotional the subjects found the vignettes. Thus, the subjects reacted to the stimulus based on how emotional they were. How do we know how emotional they were? By how they reacted to the stimulus. Put another way, the snake is eating its own tail. By gathering no data prior to exposure to the stimulus, the experiment creates a closed system, in which hypotheses about subjects' individual characteristics are severely limited. This lesson is taught in statistics, where in running an analysis of covariance it is a given that one cannot use as a covariate any variable that is manipulated by the experimental procedure. Just as the purpose of an ANCOVA is to account for confounding variables that existed prior to the experimental manipulation, the purpose of individual differences data is to determine pre-existing characteristics of the individual subjects that may affect how they perform during the experiment. Thus, in terms of obtaining individual difference information, it is crucial to gather such data *before* the subject is exposed to the stimulus.

Individual differences data could be gathered on a number of factors. One factor could be along the lines of the "arousability" factor gathered by Andrews [36], determining how easy it is for the individual to become angry, or otherwise emotional in life. Another factor that could be important is the extent to which an individual has a vivid imagination, or the ease with which an individual can create mental images. One hypothesis would be that individuals with particularly vivid imaginations would be more susceptible to misinformation. Because they can easily create a mental image, they may be more prone to creating such an image in response to misinformation items, and consequently more likely to make an error of reality monitoring, and confuse their mental picture with the actual memory of the vignette. Another factor would be autobiographical in nature. Given that the emotional vignette hinges on issues of domestic violence and AIDS, individuals' prior experience with these issues could be significant. For example, a subject who in fact has AIDS, or who has been in abusive relationships, would be expected to have a stronger reaction to the emotional vignette than a subject with no such experience. Such *a priori* measures could be factored into the design as a covariate. To sum up, the more the experimenter knows about individual subjects prior to the experimental manipulation, the more they will be able to predict about the results, and the better they will be able to explain the resulting data.

Central vs. peripheral details. In making determinations regarding whether or not a particular item was "central" to the scene or "peripheral" to the scene, the only consideration given was spatial in nature. Objects that were either in contact with the actors, or were in between the actors, were determined to be "central," while objects that were off to the side of either actor were determined to be "peripheral." A number of

important distinctions were left out of this determination. For example, there was no effort made to distinguish between items that were in the foreground, such as the wine bottle in scene 3, and items in the background, such as the statue in scene 1. In addition, some items were presented in their traditional, "canonical" form (again, the wine bottle), while some were presented in an unusual "non-canonical" form. The paper plate in scene 3, for example, is presented as a decoration on the refrigerator, rather than as one would expect, lying on a table. No distinction between these types of items was made. So many differences existed between the various items, that efforts to explain differences in data between "central" and "peripheral" types of items, particularly in consideration to how misinformation influenced them, quickly devolved into taking each item on an individual basis. Thus, the advantage of collapsing the items into central and peripheral types disappeared.

In essence, the distinction between "central" and "peripheral" items rested on a presumption that the space containing the two actors, including that space between them where the central items were located, would be where the attention of the subjects would be distributed. The central items would thus benefit from being in the overall area of interest, and be more easily recognized in the emotional condition. They would also be less easily recognized in the neutral condition, on the presumption that the subject's attention would be more evenly distributed across the space of the scene. This assumption overlooked the possibility that attention could be placed between the actors solely, without including the central area between them. In this instance, the central items would then "fade into the background," and thus be more like the peripheral items with respect to how much attention they received. The results do show, however, that central

items were more accurately recognized than peripheral items, suggesting that their placement in the scene did have an impact on how readily the subjects recognized them.

Misinformation. In the present experiment, it can be said that not all misinformation was "created equal." In some instances, the misinformation simply offered incorrect information. In other instances, it directly contradicted what was actually present in the vignettes. As has already been noted, for example, one of the misinformation items states that there is a bag of chips on the counter in scene 3. In actuality, there is a teapot there, with no space for a bag. In this instance, then, the misinformation directly contradicts the facts, which may affect both its likelihood of being accepted, and the subsequent recognition of the real item. This is different from other misinformation, which suggest that an item is present when in fact it is not. These differences in the "type" of misinformation, because they were not accounted for in the initial design, introduce confounds when efforts are later made to explain differences between misinformation in different scenes. In future studies, it would be important to either ensure that all suggested misinformation is of the same kind, or make the differences in misinformation (i.e. item present/item absent vs. real item/suggested item) another within-subjects variable.

Conclusions

The present study has sought to find a connection between the concepts of emotional memory and misinformation acceptance. On their own, these concepts are complicated enough. Combining them can be a challenge that is at times very intriguing, and at times very frustrating. Formulating an experiment that does memory justice inevitably leads to an explosion of variables and a demonically tangled design. When the

urge to simplify comes, there is the danger of making the “memory” measured something that could only occur in the laboratory. Finding the balance between these extremes is one of the most challenging aspects of researching this area, and one that it is hoped has been sufficiently met here. It is hoped that the present study has demonstrated that emotional memory and misinformation acceptance are concepts that deserve to be considered in concert, and that further study in this area is not only merited, but also potentially very rewarding.

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BIOGRAPHICAL SKETCH

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