

THE PERSISTENCE OF INFERENCES IN MEMORY
FOR YOUNGER AND OLDER ADULTS

A Thesis

by

JIMMEKA GUILLORY

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2009

Major Subject: Psychology

THE PERSISTENCE OF INFERENCES IN MEMORY
FOR YOUNGER AND OLDER ADULTS

A Thesis

by

JIMMEKA GUILLORY

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Approved by:

Chair of Committee,	Lisa Geraci
Committee Members,	Steven Smith
	Jyotsna Vaid
	Jeffrey Liew
Head of Department,	Les Morey

May 2009

Major Subject: Psychology

ABSTRACT

The Persistence of Inferences in Memory
for Younger and Older Adults. (May 2009)
Jimmeka Guillory, B.S., Texas A&M University
Chair of Advisory Committee: Dr. Lisa Geraci

Younger and older adults' susceptibility to the continued influence of inferences in memory was examined using a paradigm implemented by Wilkes and Leatherbarrow. Research has shown that younger adults have difficulty forgetting inferences they make after reading a passage, even if the information that the inferences are based on is later shown to be untrue. The current study examined the effects of these inferences on memory in the lab and tested whether older adults, like younger adults, are influenced by the lingering effects of these false inferences. In addition, this study examined the nature of these inferences, by examining younger and older adults' subjective experiences and confidence associated with factual recall and incorrect inference recall. Results showed that younger and older adults are equally susceptible to the continued influence of inferences. Both younger and older adults gave primarily remember judgments to factual questions but primarily believe judgments to inference questions. This is an important finding because it demonstrates that people may go against what they remember or know occurred because of a lingering belief that the information might still be true. Also, the finding that participants do actually give more believe responses to inference questions is important because it demonstrates that there is a third state of awareness that people will

readily use when making inferences. Participants were also more confident when making remember and know judgments compared to believe judgments. This is an interesting finding because it supports the theory that both remember and know judgments can be associated with high confidence.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Lisa Geraci, and my committee members, Dr. Steven Smith, Dr. Jyotsna Vaid, and Dr. Jeffrey Liew, for their guidance and support throughout the course of this research.

Thanks also go to the Texas A&M University undergraduates, and the citizens of Bryan/College Station, TX., who were willing to participate in the study. Finally, thanks to Niki Quinn for her assistance with data collection and scoring.

TABLE OF CONTENTS

	Page
ABSTRACT.....	iii
ACKNOWLEDGEMENTS.....	v
TABLE OF CONTENTS.....	vi
LIST OF FIGURES	viii
1. INTRODUCTION: THE EFFECTS OF INFERENCES ON MEMORY.....	1
2. OLDER ADULTS' SUSCEPTIBILITY TO THE EFFECTS OF FALSE INFERENCES	6
3. EXPLORING THE SUBJECTIVE EXPERIENCES OF INCORRECT INFERENCES	13
4. RESEARCH DESIGN AND METHOD	15
4.1 Method.....	15
4.2 Scoring.....	18
5. RESULTS	20
5.1 Recall and Questionnaire.....	20
5.2 Subjective Judgments and Confidence	25
5.3 Additional Tests.....	29
6. SUMMARY.....	31
REFERENCES	36
APPENDIX A.....	41
APPENDIX B	43
APPENDIX C	45
APPENDIX D.....	46
APPENDIX E	47

VITA..... 48

LIST OF FIGURES

FIGURE		Page
1	Free recall of original message and correction	21
2	Remember/Know/Believe judgments for factual questions	26
3	Remember/Know/Believe judgments for inference questions	27
4	Confidence judgments for factual questions.....	28
5	Confidence judgments for inference questions.....	28

1. INTRODUCTION: THE EFFECTS OF INFERENCES ON MEMORY

In the real world, inferences can have a very powerful effect on people. Consider the following example provided by, Seifert (2002): On the nightly news there is a story about a family of four found dead in their home. The newscaster mentions that the family had dined at a local Chinese restaurant the night before. A few days later the same newscaster provides an update on the story and announces that the medical examiner on the case concluded that the family died from carbon monoxide poisoning. However, months later the Chinese restaurant goes out of business. In this example the Chinese restaurant likely went out of business because people inferred that the family in the news died from food poisoning at the restaurant, even though there was a retraction indicating that the family died from carbon monoxide. This everyday example demonstrates the powerful effect that inferences have on people; so powerful in fact that it influences peoples' behavior, even in the face of counter information.

The current study examined the effects of inferences on memory in the lab, and tested whether older adults, like younger adults, are influenced by the lingering effects of these false inferences. In addition, this study examined the nature of these inferences, by examining younger and older adult's subjective experiences associated with factual recall and incorrect inference recall.

Research has shown that younger adults have a difficult time forgetting inferences they make after reading a passage, even if the information that the inferences are based on is later shown to be untrue (see Seifert, 2002 for a review). This is an interesting

This thesis follows the style of *Consciousness and Cognition*.

finding because it shows that even though participants explicitly acknowledge that the information has been corrected, they continue to be influenced by it when answering inference questions. In the lab the lasting effect of incorrect information has been studied using a series of on-the-scene news reports (Wilkes & Leatherbarrow, 1988). In this paradigm, participants heard about a fire in progress, in one instance, and were told that, “cans of oil paint and gas cylinders” had been stored in a room where the fire started. Later messages referred to “oily smoke and sheets of flame”, “explosions”, and “toxic fumes” as features of the fire. Later still, participants read a message stating a correction, which indicated that no paint or gas cylinders had been in the storage room. Results showed that participants recalled the correction statement indicating that the storage room did not have any gas or paint, but was instead empty. However, when asked for a possible cause of the toxic fumes, participants responded using the inference based on the original information provided by the report, that paint and gas cylinders were a possible cause of the fire. This effect is important because it shows that even though people can explicitly recall that information was corrected they continue to use this incorrect initial information when making inferences.

There have been many theories about why inferences have a continued effect on memory after the information has been corrected. According to one theory, inferences persist in memory because people fail to edit their memories (Wilkes & Leatherbarrow, 1988). In particular, this theory suggests that people make elaborative inferences during reading before the correction occurs. Due to a failure in editing, these inferences appear to outlast the discrediting of the initial information. However, some findings are inconsistent with this theory. For example, results show that participants continue to

make incorrect inferences even when the correction is provided immediately after the misinformation, presumably before the participants make the original inference during reading (Johnson & Seifert, 1994). This finding suggests that inferences persist even if the participants have the opportunity to edit their inferences early in the experiment. Alternatively, participants may make inferences automatically upon reading the information, and so an immediate correction may not have an effect on participants' inferences.

The accessibility theory states that the mere presence of information in memory may lead people to incorporate it into later reasoning. If information is available in memory, regardless of its status, it may affect the conclusions that people draw (Tversky & Kahneman, 1973). As a test of this theory, after reading the correction, participants were asked to generate their own possible causes of the fire (Johnson & Seifert, 1999). The authors proposed that if the mere availability of information in memory results in its use, people should be able to rely on the alternate causes they generated. However, the results showed that generating alternatives did not decrease the likelihood of mentioning the original corrected information as an answer to the inference questions, suggesting that the availability of the alternate causes in memory was not enough for it to be incorporated into later reasoning when answering the inference questions.

Alternatively, researchers have suggested that inferences persist because participants are not provided with alternate explanations of the cause of the fire (Johnson & Seifert; 1994, 1999). In the absence of alternative explanations, participants may choose to ignore the reported inaccuracy and consider the causal story as "too good not to be true". The idea is that presenting a good explanation and subsequently ruling it out,

leaves a gap in understanding, which may cause people to have difficulty understanding the story unless an alternative explanation is presented to them (Seifert, 2002). In a test of this theory, participants were given plausible and causal alternatives to the misinformation. The results showed that providing these alternatives allowed participants to escape the continued inference effect. Thus, the results were interpreted to mean that inferences persist in memory because there are typically no alternate explanations for the original events that one has learned. Providing alternatives may be one way to help participants overcome the persistence of inferences however; it does not explain the initial causes of the persistence of inferences.

It is important to understand how the persistence of inferences affects people in order to determine what may cause this phenomenon. Numerous studies have demonstrated the robustness of the continued influence of misinformation when making inferences. This effect also has important practical relevance; for example, in the courtroom. Imagine that a juror is told something, and later they are told to “scratch that from memory”. They may be able to recall that the information was corrected but they may not be able to forget the inferences that they made about the information. Indeed, mock jury research has shown that verdicts can be influenced by a wide range of nonevidentiary factors presented both inside and outside the courtroom (Kassin & Studebaker, 1998); including testimony ruled inadmissible by the judge (Pickel, 1995; Sue, Smith, & Caldwell, 1973; Thompson, Fong, & Rosenhan, 1981; Wissler & Saks, 1985). This finding demonstrates that jurors can be influenced by information that they were told to disregard, which may be due to lingering inferences that they made about the initial information.

The continued inference effect is also important when considering what goes on in a classroom. Imagine that an instructor is giving a lecture and later goes back to correct something that was previously said. Research has shown that children, in comparison to adults, are less able to inhibit to-be-forgotten information (e.g., Harnishfeger & Pope, 1996; Lehman, Morath, Franklin, & Elbaz, 1998). So, even though the students are told to forget what they heard, they may have a hard time forgetting the information, especially the inferences they made about the original information.

The influence of inferences also has social relevance. For example, imagine that you are told that your new roommate was kicked out of their last apartment. Later you are told that this is not true. Even after the correction you may continue to have suspicions about whether they will be a good roommate (e.g., Tanford & Penrod, 1984; Yamauchi, 2005). In addition, research has demonstrated that it may be even more difficult to forget this information, or the inferences made from it, because it is negative or unpleasant (Isbell, Smith, & Wyer, 1998). So, the continued influence of misinformation when making inferences can influence small things such as decisions about where to eat to more important things like judgments and perceptions about people.

However, despite its robustness and importance, the continued inference effect is not well understood. Also, it is surprising that older adults have not been examined using this paradigm, because older adults are often jurors in court cases, and are consumers of news information.

2. OLDER ADULTS' SUSCEPTIBILITY TO THE EFFECTS OF FALSE INFERENCES

There are reasons to predict that older adults would be more susceptible to the continued influence of inferences. There are also reasons to predict that they would be less susceptible. One reason why older adults may be more susceptible to the continued influence of inferences is because research in the false memory literature shows that older adults are often misled by false information, and are more susceptible to misinformation in an eyewitness testimony paradigm (e.g., Cohen & Faulkner, 1989; Roediger & Geraci, 2007; LaVoie, Mertz, & Richmond, 2007). One theory is that older adults are more susceptible to misinformation because of an accessibility bias (Jacoby, 1999). According to this theory older adults' are more susceptible to misinformation because they cannot recollect the earlier event, making it necessary for them to rely more on recent information available in memory. Older adult's inability to recollect the earlier event could have important implications for the current study because, older adults may rely on the inferences made with the misinformation if they cannot recall the correction. So older adults may make the same incorrect inferences as younger adults but they may fail to explicitly recall the correction. Also, numerous studies have used the Deese-Roediger-McDermott (DRM) paradigm to show older adults' greater susceptibility to misinformation. In the DRM paradigm participants study a list of words (e.g., bed, rest, awake, etc.), each related to a nonpresented critical lure word (e.g., sleep). The results show that older adults are more likely than younger adults to false alarm to nonstudied

lures (e.g., McCabe & Smith, 2002; Watson, McDermott, & Balota, 2004; Balota, Cortese, Duchek, Adams, Roediger, McDermott, et al., 1999).

Another popular theory is that older adults have more difficulty than younger adults identifying the source of information, and this causes them to have more false memories (e.g., Dehon & Brédart, 2004; Watson et al., 2004; Roediger & Geraci, 2007). This theory suggests that older adults may be more susceptible to the continued influence of inferences because they may not be able to recall the source of the correction, which would cause them to use the original information when making inferences.

Perhaps most relevant for the current proposal, research has shown that in comparison to young adults, older adults are more likely to erroneously recognize pragmatic inferences (McDermott & Chan, 2006). This was demonstrated by giving participants the following example sentence: “The karate champion *hit* the cinder block”. After reading the sentence participants erroneously recalled having read the verb *broke*. When faced with the original sentence and the pragmatic inference on a forced-choice recognition test, older adults were more likely than younger adults to choose the inference option instead of the correct option. This finding has important implications for the proposed study because, even though it uses a different paradigm, it shows older adults greater susceptibility to the influence of inferences.

The second reason why older adults may be more susceptible to the continued influence of inferences is because of an inhibition deficit. A great deal of research, including the memory and reading comprehension literature shows that older adults may have trouble inhibiting irrelevant information (e.g., Hamm & Hasher, 1992; Hasher & Zacks, 1988; Zacks, Hasher, Doren, Hamm, & Attig, 1987). According to this theory,

when older adults are exposed to the original information it becomes activated, however later, when they are exposed to the correction it also becomes activated. The inhibition deficit theory argues that older adults have difficulty resolving the response competition between these two bits of information and are unable to inhibit the irrelevant information to select the relevant information at test.

In the reading comprehension literature this has been tested using “garden path sentences”. In this paradigm participants are given verbs that at one point in time could have two possible meanings activated (for example, ‘shot’ referring to taking a picture and ‘shot’, referring to shooting a gun). The typical finding is that older adults keep active the irrelevant meaning longer than younger adults (Hamm & Hasher, 1992; Hasher & Zacks, 1988; Zacks, Hasher, Doren, Hamm, & Attig, 1987). Results from these reading comprehension studies suggest that, just as they have problems forgetting an irrelevant interpretation of a word, older adults may have trouble forgetting inferences.

Another reason why older adults may be more susceptible to the continued influence of inferences is because they may have difficulty intentionally forgetting information. One critical distinction between the false memory paradigms (e.g., Gallo & Roediger, 2003) and the inference paradigm (e.g., Wilkes & Leatherbarrow, 1988) is that, in a false memory paradigm participants aren’t told anything about the misinformation. In the inference paradigm participants are implicitly instructed to ignore or forget the information, this aspect of the paradigm resembles a directed forgetting task. There have only been a handful of studies that examine age effects using the directed forgetting paradigm. One study comparing directed forgetting in younger and older adults found that, when using the item method, (participants are presented with a list of words and

each word is individually cued as “to be forgotten” or “to be remembered”) directed forgetting was observed in both groups, however, the effect was smaller for older adults on both recall and recognition (Hasher, Zacks, Stoltzfus, & Kane, 1996). This finding has been replicated in numerous studies (e.g., Andrés, Van der Linden, & Parmentier, 2004; Sego, Golding, and Gottlob, 2006). When the list method is used (“to be forgotten” and “to be remembered” items are presented in separate lists and the instruction to forget is typically presented after an initial list), the overall finding is that older adults show directed forgetting in recall but not recognition (e.g., Sego, Golding, and Gottlob, 2006; Basden, Basden, & Gargano, 1993; Geiselman, Bjork, & Fishman, 1983). All of the findings have been interpreted as support for the hypothesis that older adults are less able than younger adults to inhibit information (e.g., Hamm & Hasher, 1992; Hasher & Zacks, 1988; Zacks, Hasher, Doren, Hamm, & Attig, 1987).

An additional reason why older adults may be more susceptible to the continued influence of inferences is because research has shown that older adults rely more on gist-based encoding and retrieval operations, whereas younger adults are able to remember specific information (Castel, Farb, & Craik, 2007; Kensinger & Schacter, 1999; Tun, Wingfield, Rosen, & Blanchard, 1998; Adams, Labouvie-Vief, Hobart, & Dorosz, 1990; Koutstaal, Schacter, Galluccio, & Stofer, 1999; Koutstaal, 2003; Geraci, McDaniel, Manzano, & Roediger, in press). This is important because, it suggests that if younger adults have more distinctive, recollective material available to them then they may be more likely to recall the correction when answering inference questions. Since older adults have been shown to rely more on gist, they may be less likely to recall the correction when making inferences. This does not mean that older adults do not encode

the details of the story, they may just be less likely to use the details when tested (Koutstaal, 2003).

In contrast, there are also reasons to believe that older adults may be less susceptible to the continued influence of inferences. For example, older adults may be less susceptible to the lasting effects of inferences on memory because they may not be able to make initial inferences as well as younger adults (Cohen, 1979; Hasher & Zacks, 1988; Zacks et al., 1987). There seems to be a debate in the reading comprehension literature about older adults' ability to make inferences after reading a passage. The results appear to depend on a number of factors. First, older adults are less accurate than younger adults when making inferences that are based on implicit facts but not when the facts are explicitly stated (Cohen, 1979). For example, if older adults are told that it is autumn they can make inferences about the weather, however if they are told that there are leaves on the ground they may have a harder time making inferences about the temperature and things of that nature. This finding suggests that older adults may have difficulty generating inferences. In contrast, older adults are likely to show evidence of inference generation when the sentences are highly related, when the connection is explicitly presented, the inference is highly expected, and when reading is self paced (Hasher & Zacks, 1988; Zacks, et al., 1987). Therefore, it seems that older adults' ability to make inferences is more dependent on saliency than on necessity. So, older adults may be more likely to make an inference if the information is presented in a way that makes it easy for them to do so; as opposed to making the inference because it is necessary for comprehension. This is an important finding for the current study because it suggests that older adults may not be able to accurately answer the inference questions, since the

information that the inferences should be based on has been corrected and is not very explicit. For example, in the current paradigm used by Wilkes and Leatherbarrow (1988), one inference question asks about a possible cause of the explosions during the fire. Even though the correction explicitly states that the storage room was empty and there was no gas or paint, older adults may not rely on this information when making inferences because there may be confusion between the initial information and the correction, causing it to be less salient. They may not use any of the provided information at all and come up with their own explanation for the cause of the explosions. There has also been research done in the reading comprehension literature that examines older adults' ability to make bridging versus predictive or elaborative inferences but the data is mixed. Studies have found that older adults can make bridging inferences (those that are necessary for comprehension) just as well as younger adults when they are tested immediately compared to more delayed testing measures (Cohen, 1979, 1981). In contrast, for elaborative inferences (those that relate to general world knowledge rather than to current text processing demands) delayed memory measures show age differences favoring younger adults in some studies (Light, Valencia-Laver, & Zavis, 1991; Till, 1985; Till & Walsh, 1980; Burke & Yee, 1984) but not in others (Belmore, 1981; Hess & Arnould, 1986; Radvansky, Gerard, Zacks, & Hasher, 1990).

The second reason why older adults may be less susceptible to the continued influence of inferences is because of an encoding deficit (e.g., Spencer & Raz, 1995). This hypothesis attributes age-related memory problems to an inability to encode the necessary information. So if this were true, the original information that would enable older adults to make the inferences would not be encoded in the first place. Similarly,

older adults might not encode the original information as well as younger adults because of working memory deficits (e.g., Haut, Chen, & Edwards, 1999). The original study on the continued influence of inferences found that participants with low working memory scored worse on a free recall of the story compared to participants with a higher working memory (Wilkes & Leatherbarrow, 1988). However, participants with a low working memory were not more likely to use the original information when making inferences than those with a high working memory. This may be because they never encoded the information to begin with, so they failed to mention the paint and oil cans on the inference questions. If older adults have a lower working memory, they may not be able to encode the original information as well as younger adults with a higher working memory. Thus, they will not be as susceptible to the continued influence of the inference.

Finally, older adults may not show a memory deficit with the paradigm because the critical information is meaningful and important for the story. Research shows that age effects in memory are not obtained for more meaningful (Castel, Farb, & Craik, 2007; Castel, Benjamin, Craik, & Watkins, 2002; Rahhal, May, & Hasher, 2002) or emotional (Kensinger, 2008) information.

In sum, there are reasons to make predictions on both sides. Older adults may be more or less susceptible to the continued influence of inferences. The current study is designed to examine the extent to which older adults will be affected by the continued influence of inferences, even in the face of corrected information.

3. EXPLORING THE SUBJECTIVE EXPERIENCES OF INCORRECT INFERENCES

As briefly mentioned earlier, the current study examined the nature of inferences by looking at younger and older adults' subjective experiences. It is difficult to understand what someone is doing or thinking when they are making an inference. Are they intentionally recalling the study event (information), is it a more automatic process, or, is the inference retained because it has simply come to be believed? To better understand this process, we examined subjective experiences. In 1985 Endel Tulving proposed a method for studying two types of memory, introducing the distinction between remember and know responses. Remembering and knowing are two subjective states of awareness that are associated with retrieval of the past. Remembering refers to a vivid recollection for ones' personal past, one in which an individual becomes consciously aware again of some event or experience, while knowing refers to impersonal knowledge of the past; this includes the general sense of familiarity we have about more abstract knowledge.

We predicted that in the inference paradigm there will likely be more remember responses for the factual questions that participants will receive about the stories. Younger adults should also be much more likely to give remember judgments than older adults (Perfect & Dasgupta, 1997). Then the question is, what response will younger and older adults have for inference questions? To assess the subjective experience associated with inferences we included a third option, believing. We predicted that believing could be dissociated from knowing (or familiarity) because people provide a know judgment when they are certain that the item was studied but they cannot consciously recollect

anything about its actual occurrence. In contrast, a believe judgment would not require a person to be certain or to rely on a memory. The information may just feel plausible, or the person simply believes it to be true. It can also be dissociated from a remember response because it doesn't require a person to be certain because they have a recollection for an event or time in the past. For example, one might recall the incident with the trapped coal miners in West Virginia in January of 2006. Initially the miners' families were told that all but one of the thirteen miners had been found alive, only later to be told that twelve of the missing thirteen miners were actually dead. Hearing that they were alive and then being told that indeed they were not may have been more difficult for the families than if they had known the truth from the beginning. They may believe that they are still alive even in the face of the corrected information, questioning why they would have been told they were alive if this were not true. Similarly, with the lab paradigm, one interpretation is that participants continue to believe the original information because they have a suspicion that they wouldn't have been told the information if it weren't true. So one hypothesis is that participants may give more believe responses to the inference questions than the factual questions. We also included a post test questionnaire to determine why participants thought they had been given a correction.

In the current study, participants also provided confidence judgments. Asking participants how confident they are about their inferences and factual knowledge about the stories aids in understanding the process of making an inference. It also helps us to determine how these subjective experiences relate to confidence.

4. RESEARCH DESIGN AND METHOD

4.1 Method

Participants. Forty younger adult participants from Texas A&M University and 39 older adult participants from the Bryan/College Station community participated in the study. Younger adults received course credit and older adults received a \$10 honorarium for their participation. All participants were given a vocabulary test, a short demographic/education questionnaire, and a working memory test. Participants were also given neuropsychological tests to assess general levels of cognitive functioning. Older adults were given the Mini-Mental Status Examination (MMSE; Folstein, Folstein, & McHugh, 1975) before testing. Both older and younger adults received a FAS test after the experiment to assess verbal fluency. Overall younger adults ($M = 44.68$; $SD = 11.29$) scored higher than older adults ($M = 43.36$; $SD = 11.46$) on the FAS test, however this difference was not significant $F(1, 77) < 1$. Younger and older adults' were also given a reading span test to assess their working memory ability. Overall younger adults ($M = 3.03$; $SD = .97$) scored higher than older adults ($M = 2.69$; $SD = .92$) on the reading span test, however this difference was not significant $F(1, 77) = 2.43$, $MSE = 2.19$, $\eta^2_p = .03$.

Design. The study used a 2x2 mixed design with age (young and old) as the between subjects variable and condition (control and corrected) as the within subjects variable. Younger and older adults received two incident files (fire and office/missing person), one used for the control and the other used for the correction condition. For each participant, the order of the incident files were counterbalanced, as well as the condition (control or correction) assigned to each file.

Materials. Two versions of two different incident files, modified (using more standardized American English) from Wilkes and Leatherbarrow (1988), were used. Each incident file consisted of 13 discrete messages (See Appendices A and B). The first file sequence deals with the progress of a fire at a commercial premise, and the second deals with a missing person (MP) and his subsequent accident.

Participants reading the control Fire file read 13 messages describing the fire, its progress, and its consequences. The fifth message in the sequence referred to the police having reports of an empty side room adjoining a storage hall, which, in turn, was full of paper and photocopying equipment; the twelfth message was an enquiry from the police concerning how the firemen were getting on. For participants reading the control Accident file, Message 5 read that MP's employer said he had finished work at 7:00pm, and they go on to learn that he has been involved in a car accident on his way to meet his girlfriend after work. Thus, a "personal meeting" subtheme applies to the later details of his movements.

For the corrected version of the fire file, participants read exactly the same sequence of messages as the control, except that they were informed on Message 5 that the police had reports that the side room contained carelessly stored paint cans and gas cylinders. This is corrected at Message 12, after the enquiry about how the investigation was proceeding. In the corrected version, the earlier police message (Message 5) is denied, followed by the correct description of the empty room. Thus for participants reading the control fire file, after they read Message 5, later messages describing various features of the fire could be interpreted with reference to the "stored stationary" subtheme. For the participants reading the correction however, while this subtheme is

available to them, the intervening content could also be interpreted with reference to the “volatile materials” subtheme, which in many ways provides a better explanation. For the participants reading the corrected version of the Accident file, Message 5 states that MP was sent on an emergency delivery by his employer. Only at Message 12 do they learn that this was not true, and he finished work at 7:00pm. They, therefore, have the additional subtheme of an “emergency delivery” based on the old message, which then has to be amended after the correction.

Participants were informed at the outset that they will be asked to recall the information later. They were told:

We are interested in how people understand and remember reports. In this experiment you will see a series of statements, all of which related to one event. You are to go through them at your own pace, then we will ask you to recall what you have seen. Once you have turned to a new message please do not turn back and re-read any previous information.

Once participants finished reading the statements they were told:

Now, we would like you to write down, as accurately as possible, your account of what is known about the event in question.

For both incident files, participants received a 20 item questionnaire, also taken from Wilkes and Leatherbarrow (1988). Half of the questions were designed so that they could be answered by recalling the literal content (e.g. “When was the fire department dispatched?”), whereas the other half of the questions required the use of an inference to answer them (e.g. “What could have caused the explosions?”). Participants were also given a final question (or two for the accident file), which directly ask about the

correction (for the fire file they were asked, “What was the point of the second message from the police?” For the accident file they were asked, “What emergency was referred to?” and “What was the point of the second message from MP’s employer?”). The order of the test questions was randomized for each subject, except that the question(s) concerning the correction of the wrong information always came at the end (See Appendices C and D). Participants received both questionnaires immediately after reading the corresponding incident file.

After each question (factual or inference) participants made a Remember, Know, or Believe judgment. Then they were asked to rate their confidence level for each question on a scale of 1-7. Then they received instructions (See Appendices E) about how to make these judgments after reading the incident reports. The participants were also given a demographic questionnaire between the incident files, and they were given a working memory test, vocabulary, and FAS test at the end of the experiment.

4.2 Scoring

Free Recall. The message sequences for each treatment group were analyzed into their component idea units (using an adaptation of procedures described by Kintsch, 1974). The recall protocols were scored for accuracy of recall of each unit (the information units scored are indicated in the questionnaire, and they do not attempt to distinguish all levels of propositional detail). A unit was recorded as being recalled if a subject reproduced all or a substantial part of its content; otherwise it was scored as being absent. Errors and inferences were recorded separately. The scoring was carried out by two judges acting independently.

Comprehension (Questionnaire). The old/new subtheme was used in scoring the inference questions on the questionnaire, based on the source of the information underlying an inferred answer. The percentage of answers that could be unequivocally identified by the judges as deriving from one or the other subtheme (Fire old subtheme= volatile materials, Fire new subtheme= stored stationary, Accident old subtheme=emergency delivery, Accident new subtheme= personal meeting). Although the control group was never exposed to an “old” subtheme, certain questions could be answered in a manner that would be scored as “old”. It is possible that participants’ answers were not always clear cut, for either file sequence. For example, a participant might reply giving more than one answer and draw upon both subthemes. In these cases, only a new score was recorded. Alternatively, a participant could give an answer based on the old theme but then qualify it later e.g. (for example in the fire file) “According to the original message from the police there were gas and paint cans in the storage room. However, there is some doubt because later the police changed the statement”. In these cases also, the reply was assigned to the new theme. Thus the inferences attributed to the old theme for both file sequences were unqualified references to information that had been designated as incorrect.

5. RESULTS

The alpha level was set at $p < .05$ for the following analyses. Effect size (η^2_p) and mean square error (MSE) are reported for each statistic.

5.1 Recall and Questionnaire

Free Recall. The free recall test was scored by “idea units”. An idea unit was recorded as being recalled if the participant reproduced all or a substantial part of its content; otherwise it was scored as absent. Idea units were scored by two judges acting independently. Agreement levels for the analysis were high, averaging around 95% agreement. We examined the influence of age and condition (inference vs. control) on overall recall performance. As expected, the 2 x 2 analysis of variance (ANOVA) showed that recall was higher for younger adults relative to older adults $F(1, 77) = 23.73$, $MSE = 1.29$, $\eta^2_p = .24$. Recall was not influenced by condition, $F(1, 77) < 1$, and there was no interaction between the age and condition on recall performance, $F(1, 77) < 1$.

Next, we looked at the participants’ recall of the original message and the correction for those participants in the correction condition. For example, in the fire story the original message stated that there was paint and gas in the storage room, and the correction stated that the room was empty. Results showed that the majority of participants recalled both the original message and the correction (75% of younger adults and 62% of older adults). This difference in recall for younger and older adults was not significant, $F(1, 77) = 1.65$, $MSE = .36$, $\eta^2_p = .02$. There was no significant difference between the number of participants who only recalled the correction (3% of younger adults and 10% of older adults recalled only the correction), $F(1, 77) = 2.0$, $MSE = .12$,

$\eta^2_p = .03$. Younger adults were more likely to recall only the original message compared to older adults (18% of younger adults and 10% of older adults recalled only the original message), $F(1,77) < 1$, though this difference was not significant (see Fig. 1).

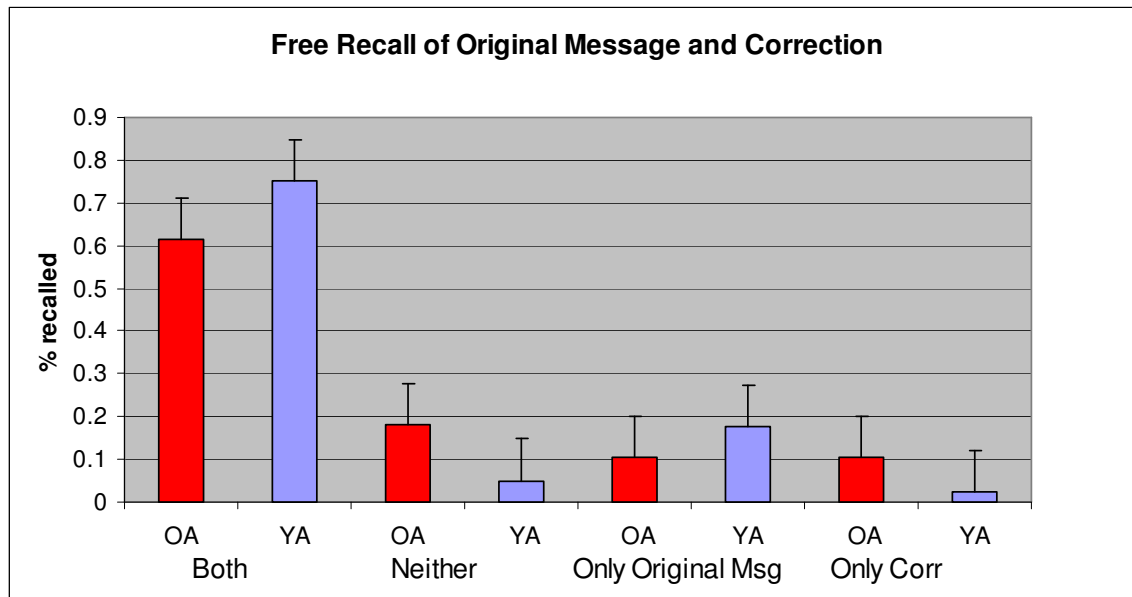


Fig. 1. Free recall of original message and correction.

Questionnaire Responses. Next, we examined responses to the questionnaires. Half of the questions on the questionnaire were inference questions and the other half were factual questions. An example, a factual question for the fire story asked, “What time was the fire department dispatched?”. (The correct answer is 9pm). Results from the 2 x 2 ANOVA (for condition and age) showed a main effect of age, $F(1, 77) = 8.95$, $MSE = .55$, $\eta^2_p = .10$ showing that younger adults remembered more factual information compared to older adults. There was no effect of condition, $F(1,77) < 1$, and no interaction between the two variables, $F(1, 77) < 1$.

Next, we examined younger and older adults' susceptibility to inferences. As an example, an inference question for the fire story asked, "Why did the fire spread so quickly?". The answer to this question was not explicitly mentioned during the story, but participants could answer using inferences that they made based on the original message. Responses to the inference questions were scored as using either the old subtheme (that is, the inference was based on the original message), the new subtheme (the inference was based on the corrected information), or some other (nonstudied) subtheme. Using the fire story as an example, inference questions were scored as using the old subtheme if participants answered the question using the original (incorrect) information regarding the presence of paint cans and gas cylinders. Inference questions were scored as using the new subtheme if participants answered the question using the alternate information regarding the presence of paper and photocopying equipment.

In the control condition participants never saw the message containing the "old" subtheme information (paint and gas), so use of the "old" subtheme in this condition provides a measure of baseline performance. The means for the use of the old subtheme in the control condition were very low for both younger ($M = .04$; $SD = .08$) and older adults ($M = .01$; $SD = .05$) and, and there were no significant differences between the age groups, $F(1, 77) = 2.94$, $MSE = .01$, $\eta^2_p = .04$. In the correction condition, results showed that both younger adults ($M = .28$; $SD = .19$) and older adults ($M = .25$; $SD = .20$) used the old subtheme even after it has been corrected, $F(1, 77) < 1$.

Because there were differences in the level of initial recall performance between younger and older adults, we examined the use of the inferences (use of the old subtheme) for participants who had recalled both the original and the correction

messages. This analysis included 24 older adults and 30 younger adults. Results showed that younger ($M = .25$; $SD = .20$) and older adults ($M = .28$; $SD = .20$) were still equally likely to use of the old subtheme, $F(1, 77) < 1$.

We also examined the number of older and younger adults who used the old subtheme in the correction compared to those who never mentioned the old subtheme. However, we found no significant differences between the number of older adults (29 older adults used the old subtheme at least once, 10 older adults *never* used the old subtheme) who used the old subtheme and the number of younger adults who used the old subtheme (32 younger adults used the old subtheme at least once, 8 younger adults *never* used the old subtheme).

Next we looked at participants' use of the new subtheme. Participants were exposed to the new subtheme in both the correction and control conditions, however in the control condition the new subtheme was the only explanation provided as a cause of the fire. In the correction condition, participants saw the original message (paint and gas in the *side room*), the correction (the *side room* was empty) and the information about the paper and photocopying equipment in the *storage room*. In the control condition younger adults ($M = .52$; $SD = .17$) answered more questions using the new subtheme than older adults ($M = .41$; $SD = .19$), $F(1, 77) = 7.11$, $MSE = .24$, $\eta^2_p = .09$. This is consistent with the factual question and free recall data, showing that younger adults have better memory for veridical information. In the correction condition, there was no difference in younger ($M = .33$; $SD = .23$) and older ($M = .32$; $SD = .22$) adults' use of the new subtheme, $F(1, 77) < 1$. It seems as if having an alternate explanation, even if it was later said to be untrue, decreased the use of the new subtheme for both younger (younger adults were

19% less likely to use the new subtheme in the correction condition in comparison to the control condition) and older adults (older adults were 10% less likely to use the new subtheme in the correction condition in comparison to the control condition). So, numerically younger adults seemed to be a little more susceptible to the continued influence of the original message.

It is notable that a large number of responses, particularly for older adults, fell into the “other” category. In the control condition younger adults responded to inference questions with “other” answers about 44% of the time and older adults about 57% of the time, and this difference was significant, $F(1, 77) = 11.42$, $MSE = .35$, $\eta^2_p = .13$. In the correction condition, younger (39%) and older (43%) adults responded based on an “other” subtheme, but this difference was not significant, $F(1, 77) = 1.07$, $MSE = .03$, $\eta^2_p = .01$. A 2 x 2 ANOVA (for condition and age) showed a main effect of age, $F(1, 77) = 7.90$, $MSE = .29$, $\eta^2_p = .09$, a main effect of condition, $F(1, 77) = 16.80$, $MSE = .36$, $\eta^2_p = .18$, and a significant interaction between the two variables, $F(1, 77) = 4.24$, $MSE = .09$, $\eta^2_p = .05$.

To examine whether the questionnaire data were influenced by condition order (the control vs the correction story first), we analyzed the data looking at only the first story (control and correction conditions). However, the results were not different from the collapsed results.

Knowledge of the Correction. At the end of each questionnaire participants were asked about the point of the critical correction message. For the fire story, the critical message was the second message in the list from the police. For the accident story, the critical message was the second message from the employer. Participants in the

correction condition received a correction to an earlier message, while participants in the control condition received a message that simply referred to the progress of the investigation. A 2 x 2 ANOVA (for condition and age) showed that overall younger adults were more likely than older adults to recall the point of the critical message, $F(1, 77) = 4.56$, $MSE = 1.08$, $\eta^2_p = .06$. Participants had better memory for the critical message when it was a correction than a control message, $F(1, 77) = 21.43$, $MSE = 4.30$, $\eta^2_p = .22$, but younger and older adults were not differentially influenced by the condition manipulation, $F(1, 77) = 1.26$, $MSE = .25$, $\eta^2_p = .02$. Thus, these data show that despite the fact that participants, and younger adults in particular, knew that there was a correction a large number of both younger and older adults used inferences from the original message to answer questions about the stories. Therefore, the younger adult data replicates the Wilkes & Leatherbarrow (1988) study, and we were also able to demonstrate that older adults are similarly susceptible to this error.

5.2 Subjective Judgments and Confidence

Subjective Judgments. Finally, we also examined the subjective experience associated with answering factual and inference questions. For each response, participants were asked to indicate whether they remembered, knew or believed the information. We hypothesized that inferences would be associated with believing, whereas factual questions would be associated with remembering. Figure 2 illustrates how often participants used each judgment to answer factual questions for both the control and correction conditions. Younger and older adults in both conditions gave more remember judgments than know or believe judgments to answer the factual questions (see

Fig. 2). A 2 x 2 x 2 ANOVA (for condition and question type on age) showed that remember judgments were most often used to answer factual questions $F(1, 77) = 53.32$,

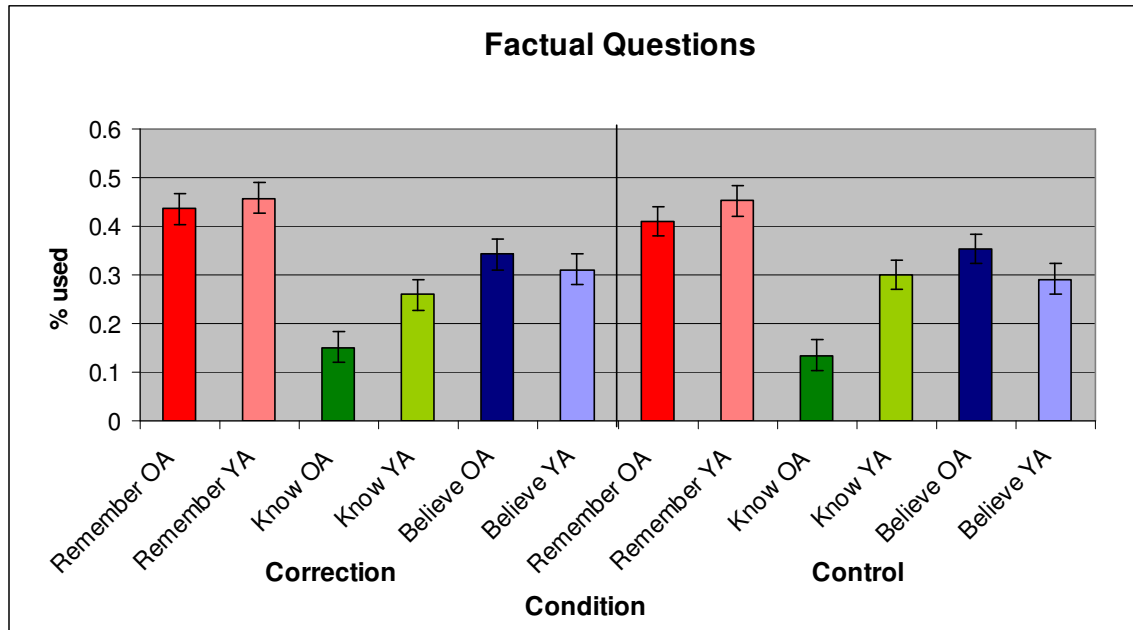


Fig. 2. Remember/Know/Believe judgments for factual questions.

$MSE = 2.90$, $\eta^2_p = .41$. However, condition (control or correction), $F(1, 77) = 2.05$, $MSE = 3.17$, $\eta^2_p = .03$, and age, $F(1, 77) < 1$, were not significant. Interestingly, the data also show that believe judgments were used more often than remember or know judgments when answering inference questions, in both conditions, $F(1, 77) = 39.53$, $MSE = 3.15$, $\eta^2_p = .34$. And similar to remember judgments, condition, $F(1, 77) < 1$, and age, $F(1, 77) < 1$, were not significant (see Fig. 3). Also, for the know judgments there were no significant differences between the question type, $F(1, 77) = 2.81$, $MSE = 1.56$, $\eta^2_p = .04$, and condition, $F(1, 77) < 1$. However, there is a main effect of age, $F(1, 77) = 5.17$,

$MSE = 11.14, \eta^2_p = .06$, showing that younger adults gave more know responses than older adults.

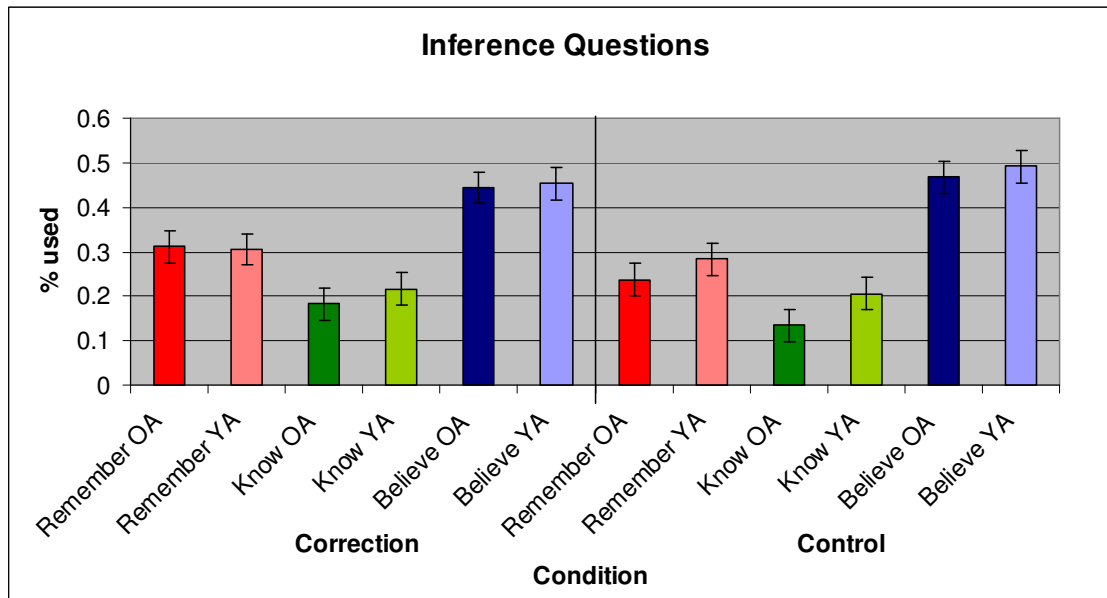


Fig. 3. Remember/Know/Believe judgments for inference questions.

Participants were also asked to rate their confidence on a scale of 1-7 (with 1 being the lowest and 7 the highest) for each response following their remember, know, believe judgments (see Figures 4 and 5). The confidence data show that younger and older adults in both conditions gave lower confidence ratings for believe judgments relative to remember judgments ($t = 10.08, df = 72, SE = .14$). They also gave lower confidence ratings for believe judgments relative to know judgments ($t = 11.05, df = 64, SE = .13$). There was no significant difference in confidence rating between remember and know judgments ($t < 1, df = 60, SE = .13$). The confidence data also show that older adults ($M = 5.26; SD = 1.05$) were more confident in their overall responses than younger

adults ($M = 4.99$; $SD = 1.02$) though this difference is not significant, $F(1, 77) = 1.33$, $MSE = 2.14$, $\eta^2_p = .02$.

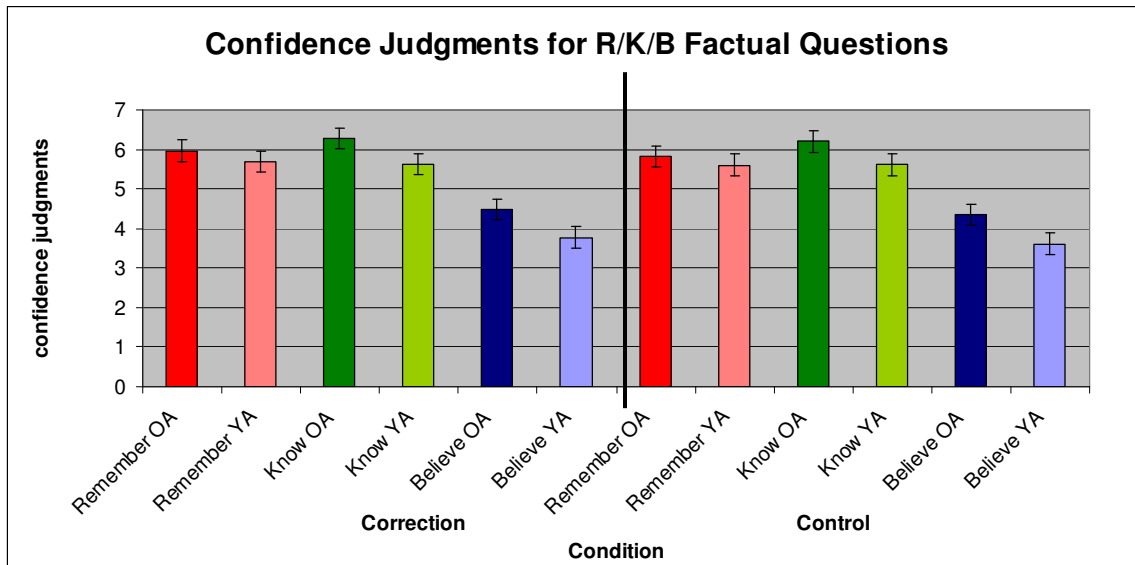


Fig. 4. Confidence judgments for factual questions.

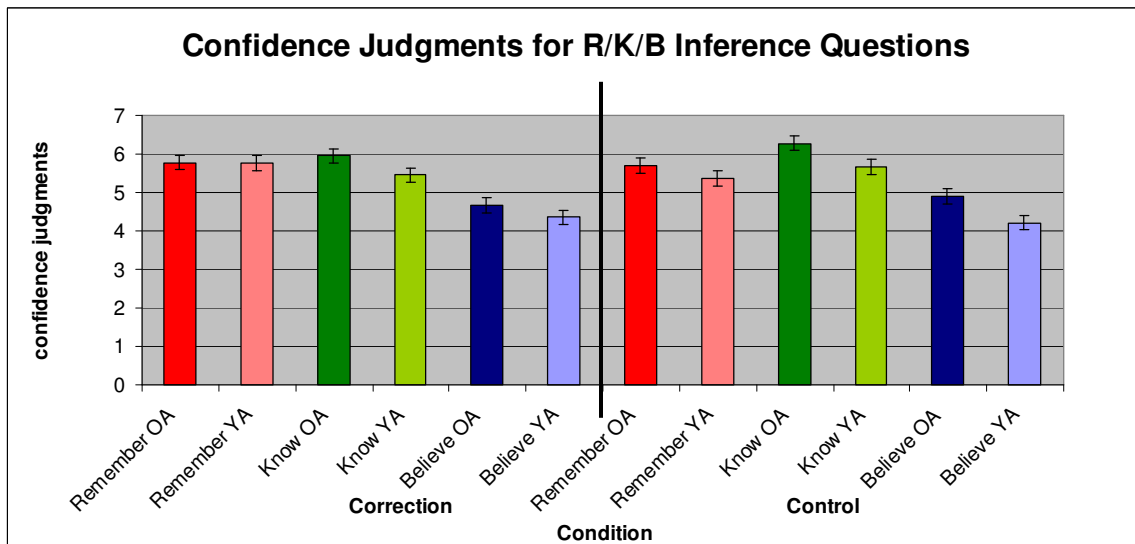


Fig. 5. Confidence judgments for inference questions.

5.3 Additional Tests

Post-Test Questionnaire. After completing the correction questionnaire, participants were given a post-test questionnaire that asked them to describe why they believed there was a correction in the story. The answers were separated into three responses; cover up, mistake, or other. If the participant believed that the correction was just a cover up for something else it was given a cover up judgment, if the participant thought the correction was simply correcting an earlier mistake the response was given a mistake judgment, or if the participant gave some other reason for the correction that could not be placed into one of these two categories it was placed in an “other” category. The results indicate that younger adults were more likely to think the correction is a cover-up and older adults were more likely to think the correction is a mistake (see Table 1).

If participants believed that the correction was a cover-up, and that the incorrect information was really true, then they may be more likely to continue using the original, incorrect information, when answering inference questions about the story relative to people who believed that the correction was a mistake. To test for this possibility, we examined the use of the old (incorrect) subtheme in the correction condition for people who said the correction was a mistake compared to those who believed it was a cover-up.

Table 1

Reasons Given for Correction: Number of participants who believed the correction was a cover up, mistake, or something other

	Age	
	Younger Adults	Older Adults
<u>Response Type</u>		
Cover Up	15	12
Mistake	18	21
Other	7	7

Participants who thought the correction was a cover-up ($M = .26$; $SD = .18$) were more likely to continue using the incorrect original message than participants who said the correction was a mistake ($M = .23$; $SD = .19$) though this difference was not significant, $F(1, 77) < 1$.

Neuropsychological Test Performance. Reading span test scores were correlated with the use of the old subtheme for participants who scored in the top versus bottom half on working memory performance. However, we did not find a correlation. The FAS scores were also correlated with the inference questionnaire data using the top versus bottom half of the data, then we compared the top versus bottom fourth of the data, however there were no significant correlations between FAS and use of the old subtheme.

6. SUMMARY

The present study examined younger and older adults' susceptibility to the continued influence of inferences. The results are consistent with previous studies (Wilkes & Leatherbarrow, 1988) showing that younger adults have a difficult time forgetting inferences they make, even though the information that the inferences are based on is later shown to be untrue. In addition, we found that older adults are equally influenced by the lingering effects of false inferences. Both younger and older adults continued to use the old subtheme even though this information had been corrected. In other words, having an alternate explanation, even if it was later said to be untrue decreased the use of the new subtheme in the correction condition for all participants. As mentioned in the introduction, there are reasons to believe that older adults would be less susceptible to the continued influence of inferences. One reason for this may be because they had difficulty making the initial inferences. Previous research has shown that older adults may not be able to make inferences as well as younger adults (Cohen, 1979; Hasher & Zacks, 1988; Zacks et al., 1987). Older adults are less accurate than younger adults when making inferences that are based on implicit facts but not when the facts are explicitly stated (Cohen, 1979). This finding suggests that older adults may have difficulty generating inferences. In contrast, older adults are likely to show evidence of inference generation when the sentences are highly related, when the connection is explicitly presented, the inference is highly expected, and when reading is self paced (Hasher & Zacks, 1988; Zacks, et al., 1987). This research suggests that older adults may be more likely to make an inference if the information is presented in a way that makes it

easy for them to do so; as opposed to making the inference because it is necessary for comprehension. So, in future studies it may be necessary to make the information that the inferences are based on more salient in order to see higher susceptibility in older adults. In the current paradigm, even though the correction was explicitly stated, older adults may not have relied on this information when making inferences because they may not have been able to keep active the original information for the correction, making the correction itself less memorable. This could be the reason why we saw so many “other” responses from older adults on the inference questions. Another theory states that older adults may have been less susceptible to the continued influence of inferences because of an encoding deficit. In the present study younger adults did have significantly better recall for the stories in comparison to older adults. However, there were no significant differences between younger and older adults in their recall of the original message and correction in the correction condition.

Interestingly, the present experiment also showed that even though younger adults remembered the correction more than older adults, they also failed to use the correction more often than older adults. This is a surprising finding because it seems that if a participant remembers the correction they would be more likely to use it than a participant who does not remember the correction, however this was not the case. The data from the post-test questionnaire may be able to shed some light on this situation. The results from the post-test questionnaire showed that younger adults were slightly more likely than older adults to think that the correction was a cover-up, and older adults were slightly more likely than younger adults to think that the correction was a mistake. So, younger adults appeared to be more suspicious about the reason for the correction

compared to older adults. Results showed that participants who thought the correction was a cover-up were more likely to continue using the incorrect original information than participants who said the correction was a mistake. So, if participants thought the correction was not true, then there should have been no reason for them not to use the original information when making inferences about the story, whereas if the participant believed that the original message was just a mistake and the correction was true, then they had no reason not to believe the correction and should no longer use the original information when making inferences.

If participants do not believe the correction then they will continue using the incorrect information. Previous research has shown that providing an alternate explanation for the original event has allowed younger adult participants to overcome the continued influence effect. This finding explained one way that participants could overcome the continued influence effect; however it failed to explain what causes the inferences to persist in the first place. The current finding that younger adults do not believe the correction provides one explanation as to why the participants continued to use the incorrect information when answering inference questions. So, in future studies, it may also be possible to get rid of the continued influence effect by making the correction more believable. This could be done by making the original information seem more like a true accident, than a cover-up.

In the current experiment we also examined the participants' subjective experiences. We found that both younger and older adult participants gave more remember judgments to factual questions and more believe judgments to inference questions. When a participant makes a believe judgment they are saying that their answer

feels plausible or they simply believe it to be true. It does not require a person to have a recollection for an event or time in the past. So the finding that participants give more believe judgments to inference questions suggests that when people make inferences they believe them to be true without evidence or support for them. Previous studies have shown that people tend to give remember judgments to veridical information, so this result was predicted (Perfect & Dasgupta, 1997). However, the second finding was more exploratory. The use of a believe judgment (rather than a remember or know judgment) suggests that participants knew the information was incorrect but it still felt plausible even in the face of counter information. This is an interesting finding because it demonstrates that people may go against what they remember or know occurred because of a lingering belief that the information might still be true. In addition, the finding that participants do actually give more believe responses to inference questions is important because it demonstrates that there is a third state of awareness that people will readily use when making inferences.

Finally, in the present study we also examined participants' confidence for each subjective judgment. The results show that both younger and older adults gave lower confidence ratings for believe judgments and higher confidence rating to remember and know judgments. There is a debate in the literature about whether or not the know judgment is associated with high or low confidence. This is an interesting finding because it supports the theory that both remember and know judgments can be associated with high confidence (e.g. Yonelinas, 2001).

In summary, the results show that older adults are as susceptible as younger adults to the continued influence of inferences. One explanation for why older adults did not

show a memory deficit in this paradigm is because the critical information was meaningful and important for understanding the story. If the critical information was less salient we may have seen age effects in memory. However, it is important to note that we did find age effects in memory for the correction. The results showed that overall younger adults were more likely than older adults to recall the point of the critical message. In addition, we found that while participants generally remembered factual information, they reported that they believed their inferences to be true.

REFERENCES

- Andrés, P., Van der Linden, M., & Parmentier, F. B. R. (2004). Directed forgetting in working memory: Age-related differences. *Memory, 12*(2), 248-256.
- Adams, C., Labouvie-Vief, G., Hobart, C. J., & Dorosz, M. (1990). Adult age group differences in story recall style. *Journals of Gerontology, 45*(1), P17-P27.
- Balota, D. A., Cortese, M. J., Duchek, J. M., Adams, D., Roediger, H. L., McDermott, K. B., et al. (1999). Veridical and false memories in healthy older adults and in dementia of the alzheimer's type. *Cognitive Neuropsychology. Special Issue: The Cognitive Neuropsychology of False Memories, 16*(3-5), 361-384.
- Basden, B. H., Basden, D. R., & Gargano, G. J. (1993). Directed forgetting in implicit and explicit memory tests: A comparison of methods. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*(3), 603-616.
- Belmore, S. M. (1981). Imagery and semantic elaboration in hypermnesia for words. *Journal of Experimental Psychology: Human Learning and Memory, 7*(3), 191-203.
- Burke, D. M., & Yee, P. L. (1984). Semantic priming during sentence processing by young and older adults. *Developmental Psychology, 20*(5), 903-910.
- Castel, A. D., Benjamin, A. S., Craik, F. I. M., & Watkins, M. J. (2002). The effects of aging on selectivity and control in short-term recall. *Memory & Cognition, 30*(7), 1078-1085.
- Castel, A. D., Farb, N. A. S., & Craik, F. I. M. (2007). Memory for general and specific value information in younger and older adults: Measuring the limits of strategic control. *Memory & Cognition, 35*(4), 689-700.
- Cohen, G. (1979). Language comprehension in old age. *Cognitive Psychology, 11*(4), 412-429.
- Cohen, G. (1981). Inferential reasoning in old age. *Cognition, 9*(1), 59-72.
- Cohen, G., & Faulkner, D. (1989). Age differences in source forgetting: Effects on reality monitoring and on eyewitness testimony. *Psychology and Aging, 4*(1), 10-17.
- Dehon, H., & Brédart, S. (2004). False memories: Young and older adults think of semantic associates at the same rate, but young adults are more successful at source monitoring. *Psychology and Aging, 19*(1), 191-197.

- Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). Mini-mental state: A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*(3), 189-198.
- Gallo, D. A., & Roediger, H. L., III. (2003). The effects of associations and aging on illusory recollection. *Memory & Cognition, 31*(7), 1036-1044.
- Geiselman, R. E., Bjork, R. A., & Fishman, D. L. (1983). Disrupted retrieval in directed forgetting: A link with posthypnotic amnesia. *Journal of Experimental Psychology: General, 112*(1), 58-72.
- Geraci, L., McDaniel, M.A., Manzano, I., Roediger, H.L. (in press). The influence of aging and frontal functioning on memory for distinctive events. *Memory and Cognition*.
- Hamm, V. P., & Hasher, L. (1992). Age and the availability of inferences. *Psychology and Aging, 7*(1), 56-64.
- Harnishfeger, K. K., & Pope, R. S. (1996). Intending to forget: The development of cognitive inhibition in directed forgetting. *Journal of Experimental Child Psychology, 62*(2), 292-315.
- Hasher, L. & Zacks, R. T. (1988). *Working memory, comprehension, and aging: A review and a new view*. San Diego, CA: Academic Press.
- Hasher, L., Zacks, R. T., Stoltzfus, E. R., & Kane, M. J. (1996). On the time course of negative priming: Another look. *Psychonomic Bulletin & Review, 3*(2), 231-237.
- Haut, M. W., Chen, S., & Edwards, S. (1999). Working memory, semantics, and normal aging. *Aging, Neuropsychology, and Cognition, 6*(3), 179-186.
- Hess, T. M., & Arnould, D. (1986). Adult age differences in memory for explicit and implicit sentence information. *Journal of Gerontology, 41*(2), 191-194.
- Isbell, L. M., Smith, H. L., & Wyer, R. S., Jr. (1998). *Consequences of attempts to disregard social information*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Jacoby, L. L. (1999). Deceiving the elderly: Effects of accessibility bias in cued-recall performance. *Cognitive Neuropsychology. Special Issue: The Cognitive Neuropsychology of False Memories, 16*(3-5), 417-436.
- Johnson, H. M., & Seifert, C. M. (1994). Sources of the continued influence effect: When misinformation in memory affects later inferences. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*(6), 1420-1436.

- Johnson, H. M., & Seifert, C. M. (1999). *Modifying mental representations: Comprehending corrections*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Kassin, S. M., & Studebaker, C. A. (1998). *Instructions to disregard and the jury: Curative and paradoxical effects*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Kensinger, E. A., & Schacter, D. L. (1999). When true memories suppress false memories: Effects of ageing. *Cognitive Neuropsychology. Special Issue: The Cognitive Neuropsychology of False Memories*, 16(3-5), 399-415.
- Kensinger, E. A. (2008). Age differences in memory for arousing and nonarousing emotional words. *Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, 63B(1), P13-P13.
- Kintsch, W. (1974). *The representation of meaning in memory*. Oxford, England: Lawrence Erlbaum.
- Koutstaal, W. (2003). Older adults encode--but do not always use--perceptual details: Intentional versus unintentional effects of detail on memory judgments. *Psychological Science*, 14(2), 189-193.
- Koutstaal, W., Schacter, D. L., Galluccio, L., & Stofer, K. A. (1999). Reducing gist-based false recognition in older adults: Encoding and retrieval manipulations. *Psychology and Aging*, 14(2), 220-237.
- LaVoie, D. J., Mertz, H. K., & Richmond, T. L. (2007). *False memory susceptibility in older adults: Implications for the elderly eyewitness*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Lehman, E. B., Morath, R., Franklin, K., & Elbaz, V. (1998). Knowing what to remember and forget: A developmental study of cue memory in intentional forgetting. *Memory & Cognition*, 26(5), 860-868.
- Light, L. L., Valencia-Laver, D., & Zavis, D. (1991). Instantiation of general terms in young and older adults. *Psychology and Aging*, 6(3), 337-351.
- McCabe, D. P., & Smith, A. D. (2002). The effect of warnings on false memories in young and older adults. *Memory & Cognition*, 30(7), 1065-1077.
- McDermott, K. B., & Chan, J. C. K. (2006). Effects of repetition on memory for pragmatic inferences. *Memory & Cognition*, 34(6), 1273-1284.
- Perfect, T. J., & Dasgupta, Z. R. R. (1997). What underlies the deficit in reported recollective experience in old age? *Memory & Cognition*, 25(6), 849-858.

- Pickel, K. L. (1995). Inducing jurors to disregard inadmissible evidence: A legal explanation does not help. *Law and Human Behavior, 19*(4), 407-424.
- Radvansky, G. A., Gerard, L. D., Zacks, R. T., & Hasher, L. (1990). Younger and older adults' use of mental models as representations for text materials. *Psychology and Aging, 5*(2), 209-214.
- Rahhal, T. A., May, C. P., & Hasher, L. (2002). Truth and character: Sources that older adults can remember. *Psychological Science, 13*(2), 101-101.
- Roediger, H. L., III, & Geraci, L. (2007). Aging and the misinformation effect: A neuropsychological analysis. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 33*(2), 321-334.
- Sego, S. A., Golding, J. M., & Gottlob, L. R. (2006). Directed forgetting in older adults using the item and list methods. *Aging, Neuropsychology, and Cognition, 13*(1), 95-114.
- Seifert, C. M. (2002). *The continued influence of misinformation in memory: What makes a correction effective?* San Diego, CA: Academic Press.
- Spencer, W. D., & Raz, N. (1995). Differential effects of aging on memory for content and context: A meta-analysis. *Psychology and Aging, 10*(4), 527-539.
- Sue, S., Smith, R. E., & Caldwell, C. (1973). Effects of inadmissible evidence on the decisions of simulated jurors: A moral dilemma. *Journal of Applied Social Psychology, 3*(4), 345-353.
- Tanford, S., & Penrod, S. (1984). Social inference processes in juror judgments of multiple-offense trials. *Journal of Personality and Social Psychology, 47*(4), 749-765.
- Thompson, W. C., Fong, G. T., & Rosenhan, D. L. (1981). Inadmissible evidence and juror verdicts. *Journal of Personality and Social Psychology, 40*(3), 453-463.
- Till, R. E. (1985). Verbatim and inferential memory in young and elderly adults. *Journal of Gerontology, 40*(3), 316-323.
- Till, R. E., & Walsh, D. A. (1980). Encoding and retrieval factors in adult memory for implicational sentences. *Journal of Verbal Learning & Verbal Behavior, 19*(1), 1-16.
- Tulving, E. (1985). Memory and consciousness. *Canadian Psychology/Psychologie Canadienne, 26*(1), 1-12.

- Tun, P. A., Wingfield, A., Rosen, M. J., & Blanchard, L. (1998). Response latencies for false memories: Gist-based processes in normal aging. *Psychology and Aging, 13*(2), 230-241.
- Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology, 5*(2), 207-232.
- Watson, J. M., McDermott, K. B., & Balota, D. A. (2004). Attempting to avoid false memories in the Deese/Roediger-McDermott paradigm: Assessing the combined influence of practice and warnings in young and old adults. *Memory & Cognition, 32*(1), 135-141.
- Wilkes, A. L., & Leatherbarrow, M. (1988). Editing episodic memory following the identification of error. *The Quarterly Journal of Experimental Psychology A: Human Experimental Psychology, 40A*(2), 361-387.
- Wissler, R. L., & Saks, M. J. (1985). On the inefficacy of limiting instructions: When jurors use prior conviction evidence to decide on guilt. *Law and Human Behavior, 9*(1), 37-48.
- Yamauchi, T. (2005). Labeling bias and categorical induction: Generative aspects of category information. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31*(3), 538-553.
- Yonelinas, A. P. (2001). Consciousness, control, and confidence: The 3 Cs of recognition memory. *Journal of Experimental Psychology: General, 130*(3), 361-379.
- Zacks, R. T., Hasher, L., Doren, B., Hamm, V., & Attig, M. S. (1987). Encoding and memory of explicit and implicit information. *Journal of Gerontology, 42*(4), 418-422.

APPENDIX A

Fire**Control Version**

Message 1: January 25th 9:00pm/ Alarm call received from premises of a Whole-Sale Stationers/ Premises consist of Offices, Display room, and Storage hall/

Message 2: A serious fire reported in the storage hall already out of control and requiring instant response/ Fire appliance dispatched at 9:00pm/

Message 3: The alarm was raised by the Night Watchman/ who referred to the presence of thick, oily smoke and sheets of flame/

Message 4: January 26th 4:00am/ Attending Fire Officer suggests that the fire was started by a short circuit in the wiring/ of a side room off the main storage hall./ Police now investigating./

Message 5: 4:30am/ Police message received to say that they have reports that the side room was empty before the fire/

Message 6: Fireman attending the scene report that the fire developed an intense heat that made it particularly difficult to bring under control/

Message 7: It has been learned that a number of explosions occurred during the blaze/ which endangered firemen in the vicinity, but no casualties resulted from this cause/

Message 8: Two firemen are reported to have been taken to hospital/ as a result of breathing toxic fumes that built up in the area in which they were working/

Message 9: 10:00am/ The owner of the affected premises estimates that total damage will amount to many thousands of pounds (dollars)/ although the premises were insured/

Message 10: The works Foreman has disclosed that the storage hall contained bales of paper and a large amount of photo copying equipment/

Message 11: A small fire had been discovered on the same premises, six months previously./ It had been successfully tackled by the workmen themselves/

Message 12: 11:00am/ A second message received from the police enquiring how the Brigade's investigation into the fire was progressing/

Message 13: 11:30am/ Attending Fire Officer reports that the fire is now out and that the storage hall has been completely gutted/

File Ends

Corrected Version

Message 5: 4:30am/ Police Received to say that they have reports that inflammable material, including paint and gas cylinders, had been carelessly stored in the side room before the fire/

Message 12: 11:00am/ A second message received from the Police enquiring how the Brigade's investigations into the fire were progressing/ and also stating that their earlier message was incorrect./ The side room had been empty before the fire. /

(The units scored at Free Recall are indicated by /...../)

APPENDIX B

Accident

Control Version

Message 1: There has been a report of a missing person (MP), a male 21 years old/ filed with the police by his parents./ They have not seen him since the previous day/ and there is no reason for his absence. /

Message 2: MP employed as a messenger by a local chemist/ who describes him as a good employee./

Message 3: A road accident outside the town/ has been reported to the police./ The victim has been injured and fits the description of MP./

Message 4: Police measurements at the scene of the accident indicate that the vehicle overshot the corner/ and then traveled through a hedge into a field./ It is now being checked for mechanical faults./

Message 5: Employer reports that he had last seen MP on Monday evening when he had finished work at 7:00pm/

Message 6: A witness traced who describes seeing MP hurriedly leaving the town centre/ at 7:15pm/

Message 7: A motorcyclist located who reports being overtaken on the outskirts of town/ around 7:25pm/

Message 8: A motorist reports that MP raced past him near the crash scene/ at 7:45pm on Monday/

Message 9: The hospital reports that the victim's injuries include limbs and concussion./

Message 10: Girlfriend of MP states that she had arranged to meet him on Monday/ at 8:00pm./ He had not turned up./

Message 11: Reports of oil on the road near the accident spot had been received by the AA on Monday/

Message 12: Second message from MP's employers enquiring how he is./

Message 13: The parents of MP have visited the hospital/ and have confirmed his identity. /

File Ends

Corrected Version

Message 5: The employer reports that he had last seen MP on Monday evening when/ he had been sent on an emergency drug delivery to a hospital some miles away./

Message 12: Second message from MP's employers enquiring how he is/ and also stating that their earlier message was incorrect./ In fact MP had finished work at 7:00pm./

(The units scored at Free Recall are indicated by /...../)

APPENDIX C

Fire Questionnaire

Factual Questions

1. When was the fire department dispatched?
2. What was the extent of the firm's premises?
3. What did the work's foreman disclose?
4. How was it thought the fire started?
5. What was the cost of the damage done?
6. Where did the alarm call come from?
7. What features of the fire were noted by the night watchman?
8. Where was the fire located?
9. What was the extent of the final damage?
10. When was the fire eventually put out?

Inference Questions

1. Why do you think the fire was particularly intense?
2. What did the police investigation reveal?
3. Is there any evidence of careless reveal?
4. Why did the fire spread so quickly?
5. What was the relevance of the side room?
6. What was the possible cause of the toxic fumes?
7. Where was the probably location of the explosions?
8. Are there any reasons why an insurance claim might be refused?
9. What could have caused the explosions?

Corrected Message Recall

1. What was the point of the second message from the police?

APPENDIX D

Accident Questionnaire

Factual Questions

1. How was MP employed?
2. What was the relevance of the AA's information?
3. When did the accident happen?
4. Why is there no statement from MP about what happened?
5. When was the accident reported?
6. Where did the crash occur?
7. What did the motorcyclist report?
8. When did MP's parents learn about the accident?
9. How long did MP's parents say he had been missing?

Inference Questions

1. Where was MP going to just before the accident?
2. When did the chemist last see MP?
3. Why did the accident happen?
4. Where was MP going in a hurry at 7:15pm?
5. What did MP do at 7:00 on Monday?
6. Did MP expect to meet his girlfriend as arranged?
7. Who owned the vehicle MP was driving?
8. What did the police measurements suggest?
9. Where was MP coming from just before the accident?

Corrected Message Recall

1. What emergency was referred to?
2. What was the point of the second message from MP's employer?

APPENDIX E

Remember/Know/Believe Instructions**Remember**

You should make a remember judgment if you can consciously recollect its prior occurrence. Remember is the ability to become consciously aware again of some aspect or aspects of what happened or what was experienced at the time the report was presented (e.g. aspects of the physical appearance of the information, or of something that happened in the room, or of what you were thinking or doing at the time). In other words, the “remembered” information should bring back to mind a particular association, image, or something more personal from the time of study, or something about its appearance or position (i.e., what came before or after that message).

Know

You should make a know judgment if you recognize the information from the report, but you cannot consciously recollect anything about its actual occurrence or what happened or what was experienced at the time of its occurrence. In other words, write “know” when you are certain that you recognize the information, but it fails to evoke any specific conscious recollection from the study time.

Believe

When making a believe judgment you don’t have to specifically recall the information, but you are indicating that you believe this particular information, it feels plausible, or you simply believe it to be true.

To further clarify the difference between these three judgments (remembering, knowing, and believing) here are a few examples. If someone asks you who was the first president of the U.S. you would typically respond in the “know” sense, without becoming consciously aware of anything about a particular event or experience of learning that information. When asked about the last movie you saw, you would typically respond in the “remember” sense that is, becoming consciously aware again of some aspects of the experience of seeing the movie. For example, you might remember where you sat, or that you were thinking. Alternatively, if someone asks you whether t.v. is bad for you, you may not recollect having learned about this issue and you may not know for sure. Rather you simply believe this to be true.

VITA

Jimmeka Guillory
 Department of Psychology
 Texas A&M University
 College Station, TX 77843-4235
 jguillory@psych.tamu.edu

EDUCATION

- | | |
|---|----------|
| M.S., Cognitive Psychology
Texas A&M University, College Station, TX | May 2009 |
| B.S., Psychology
Texas A&M University, College Station, TX | May 2006 |

RESEARCH INTERESTS

Conscious Experiences of Memory, Implicit Memory, Aging and Memory

CONFERENCE PRESENTATIONS

- **Guillory, J.**, Geraci, L., & McCabe, D. (October, 2007). Are There Two Types of Memory?: Evidence From Subjective Judgments. Poster presented at the annual Armadillo Conference, San Antonio, TX
- **Guillory, J.**, Geraci, L., & McCabe D. (September, 2007). Are There Two Types of Memory?: Evidence From Subjective Judgments. Poster presented at Texas A&M University, College Station, TX
- **Guillory, J.**, Geraci, L., & McCabe D. (March 2008). Are There Two Types of Memory?: Evidence From Subjective Judgments. Poster presented at 11th Annual Student Research Week-Texas A&M University, College Station, TX
- Geraci, L., Hamilton, M., **Guillory, J.** (November 2008). The Influence of Word Frequency and Time of Day on Age Effects in Priming. Poster presented at The 49th Annual Meeting of the Psychonomic Society in Chicago, IL

PUBLICATIONS

- Geraci, L., McCabe, D., **Guillory, J.** On interpreting the relationship between remember-know judgments and confidence: The role of instructions. *Manuscript accepted pending minor revisions.*
- **Guillory, J.** & Geraci, L. Remembering facts and believing inferences: younger and older adults memory for incorrect inferences. *Manuscript in preparation (data collected).*
- Geraci, L., Hamilton, M., & **Guillory, J.** The role of response competition and time of day on age effects in implicit memory. *Manuscript in preparation (data collected).*