

Individual Differences Related to Two Types of Memory Errors: Word Lists May Not Generalize to Autobiographical Memory

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SUMMARY

In two experiments we investigated individual differences related to memory errors. In Experiment 1, we conducted an exploratory study of several factors possibly related to the tendency to change source monitoring decisions for an autobiographical memory. We found that only the Dissociative Experiences Scale (DES) was related to this autobiographical memory error. In Experiment 2, we used both the autobiographical memory task and a word list task as measures of memory. Aspects of the DES were related to errors in both measures and imagery vividness was related to errors in the word list study. The tendency to change a source judgement for an autobiographical memory was not related to the number of errors in a word list task. Performance on word lists may not be a good predictor of an individual's performance in everyday memory tasks because the two may be based on different underlying processes. © 1998 John Wiley & Sons, Ltd.

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Adults can create false childhood memories for events that never occurred (Hyman and Billings, 1998; Hyman *et al.*, 1995; Hyman and Pentland, 1996; Loftus, 1993; Loftus and Pickrell, 1995; Pezdek *et al.*, 1997). Recently, the focus of false memory research has shifted from demonstrating the existence of false memories to investigating contextual variables and individual characteristics that may contribute to memory creation. Thus, researchers have explored aspects of the experimental context that affect the creation of false childhood memories. For example, Pezdek *et al.* (1997) found that plausibility of an event was related to false memory creation. In addition, Hyman and Pentland (1996) found that participants who described mental images of false events were more likely to create memories for the events.

In addition to contextual factors, individual characteristics play a role in the creation of false childhood memories. What characteristics allow some people, but not others, to incorporate details or whole events that did not happen into their autobiographies? Understanding the influence that personal characteristics play in the malleability of autobiographical memory may guide therapists considering using certain techniques for memory recovery with clients displaying characteristics related

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to the creation of false memories. In the legal system such information may aid in interpreting eyewitness memory evidence.

Studies of individual differences may also clarify the underlying processes involved in memory creation. Several researchers (Gudjonsson, 1988; Hyman and Billings, 1998; Johnson *et al.*, 1993; Loftus *et al.*, 1992; Schooler and Loftus, 1993) have suggested that individual differences in personality and cognition may play a role in the accuracy of memory processes. These differences may influence how people judge the plausibility of suggested events, construct a narrative and image of false events, and the criterion individuals use in making source monitoring judgements (Hyman and Kleinknecht, in press). Imagery ability and dissociative tendencies are two individual differences that appear to be related to a variety of memory errors.

The ability to imagine misleading information or a false suggested event may lead some individuals to construct rich narratives and images of false events. When people construct such images, they may be more likely to make a source monitoring error and claim the image as a memory (Johnson *et al.*, 1979, 1993). One part of the evidence for this claim is that people rate the clarity of events they remember higher than events they only imagine (Johnson *et al.*, 1988) or events they know occurred but do not personally remember (Hyman *et al.*, 1998). In addition, people who imagine suggested events are more likely to claim to remember the event than individuals who do not imagine the events (Hyman *et al.*, 1998; Hyman and Pentland, 1996; Goff and Roediger, 1998). Although these effects are generally true, there is also evidence that imagery vividness is related to the creation of false childhood memories (Hyman and Billings, 1998) and the number of semantic intrusions in word list recall (Winograd *et al.*, 1998).

Dissociative tendency is another individual difference dimension that recently has been examined in relation to memory errors (Hyman and Billings, 1998; Platt *et al.*, 1998; Winograd *et al.*, 1998). People with higher degrees of dissociation experience more frequent interruption of attention, consciousness, memory, and personality (Bernstein and Putnam, 1986). When consciousness is disrupted, the normal attentional and encoding processes may also be impaired. Thus, people who frequently experience dissociation may have autobiographical memories that are more impoverished. In addition, Hyman and Billings (1998) suggested that people with greater dissociative tendencies may have learned to integrate information from external sources into their personal narratives to create a coherent story. Thus people with dissociative tendencies may be likely to accept the plausibility of suggested events. In addition, if their sense of self is less integrated, people who dissociate frequently may be skilled at constructing narratives using information from a variety of sources, or they may have a low-source monitoring criterion for accepting narratives and images as personal memories.

One way to discern which processes (plausibility judgements, memory construction, or source monitoring judgements) are affected is to explore the subscales of the Dissociative Experiences Scale (DES; Bernstein and Putnam, 1986). Several researchers (Saunders and Green, 1994; Winograd *et al.*, 1998) have suggested that three subscales typically can be derived: memory failures, depersonalization, and absorption. Memory failures is a measure of the interruption of processes associated with memory; especially difficulties remembering activities. Depersonalization measures feelings of disconnectedness and interruptions of personality. Depersonalization is supposedly the subscale most clearly indicative of Dissociative Identity

Disorders. Absorption is the tendency to become so involved in an experience that other stimuli are ignored. It is often expressed as becoming very involved in fiction, television, and movies.

Using the subscales, Winograd *et al.* (1998) found that the number of intrusions made on semantically related word lists was related to both the depersonalization and absorption subscales. Hyman and Billings (1998) found that people who scored higher on the DES were more likely to create false childhood memories, but they did not use the subscales. We have re-analysed the Hyman and Billings data to investigate if the subscales of the DES are related to the creation of false childhood memories (in doing so, we used the same method for scoring the DES employed by Winograd *et al.*). The creation of a false childhood memory was scored as originally done in Hyman and Billings: 1 for no false memory and no effort; 2 for no false memory but attempting to remember (usually by referring to related self-knowledge); 3 for partial false memory; and 4 for clear false memory. We found that all three subscales were related to the creation of false childhood memories: memory failures, $r = 0.412$ ($p < 0.01$); depersonalization, $r = 0.370$ ($p < 0.01$); absorption, $r = 0.411$ ($p < 0.01$). All aspects of dissociative tendencies appear to be related to the creation of false childhood memories.

In this paper, we describe two additional investigations of individual differences that may be linked to memory errors. In both experiments, we used a measure of dissociative tendency (DES; Bernstein and Putnam, 1986) and of imagery ability (VVIQ; Marks, 1973, Experiment 1; IDQ; Paivio and Harshman, 1983, Experiment 2).

In both studies, we used a measure of autobiographical memory errors. Hyman *et al.* (1998) developed a method for manipulating source monitoring judgements in autobiographical memories. First, participants are told about the distinction between events they *remember* and events they *know* occurred but do not remember. Although the distinction and description are based on Tulving's (1985) work, the definition of 'know' is somewhat different for autobiographical events than for word lists. In word lists, 'know' means a strong feeling that the item was on the list without any explicit personal memory of the presentation of the item. For autobiographical events, 'know' means belief that an event occurred with all knowledge of the event based on external sources, such as family stories, pictures, etc. When participants understand the distinction, they are asked to write a brief description of an event that they know but do not remember from between the ages of two and ten.

The participants are then asked to imagine the experience and elaborate on their previous description in response to a few questions. Finally the participants rate their memory on a 7-point scale running from 'know' (1) to 'remember' (7). Hyman *et al.* (1998) found that individuals who imagined a known event rated their memory as closer to the 'remember' end of the scale than a control group that did not imagine the event. Hyman *et al.* argued they had manipulated the source judgement people made concerning the event by encouraging individuals to construct more elaborate narratives and images. This can be viewed as a source-monitoring error in that people had selected an event they claimed to know via an external source and began to attribute their knowledge to personal memory as well.

In Experiment 1, we used this method of generating autobiographical source monitoring errors to investigate a variety of individual differences. This was truly an exploratory study. In addition to the DES and the VVIQ, we used several measures that could possibly be linked to memory creation. The Measure of Ambiguity

Intolerance (MAT; Norton, 1975) indicates comfort level with ambiguity. Individuals uncomfortable with ambiguity may be less likely to modify their memory evaluation in response to manipulations. The Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1991) is a measure of providing socially desirable responses. Individuals who appear to create false memories in experiments may simply be providing what they believe is the correct response, rather than actually creating false memories. Since Hyman and Billings (1998) found no relationship of socially desirable responding to the creation of false childhood memories using the Marlowe–Crowne Social Desirability Scale (Crowne and Marlowe, 1960), we tried a different measure. The Self-Efficacy Scale (SES; Sherer *et al.*, 1982) measures individuals' beliefs that they can perform a variety of tasks effectively. Such individuals may be less open to suggestions, or conversely, more likely to succeed in retrieving information to construct a false memory. We also used a measure of Locus of Control (LOC; Rotter, 1966), since individuals with an external locus of control may be more likely to conform to external suggestions. Individuals with rigid belief systems may be less likely to respond to suggestions to construct false memories and, following Winograd *et al.* (1998), we used the Self-Righteousness Measure (SRM; Falbo and Belk, 1985) to measure rigidity of belief systems. Finally, we used a general measure of several personality traits: the Myers-Briggs Inventory (Myers and McCaulley, 1985). This measures pairs of traits: introversion and extroversion; sensing and intuition; and thinking and feeling. With the exception of introversion and extroversion, these are measures of how people tend to make judgements. Thus any of these could have been related to source-monitoring judgements.

In Experiment 2, we once again looked at whether dissociative tendencies and imagery ability are related to how readily individuals change their source monitoring judgements for autobiographical memories. Our primary goal in this experiment was the investigation of relationships among various forms of memory errors. Thus we also used a word list method of generating semantically related intrusions (Deese, 1959; Roediger and McDermott, 1995).

One could argue that the tendency to change source claims for autobiographical memory is related to the tendency to falsely recall words in word list studies. Both tasks are forms of episodic memory (Tulving, 1983) and thus should be related. In addition, both tasks appear to involve source monitoring errors (Johnson *et al.*, 1993): claiming to remember something previously attributed to an external source in the autobiographical memory task and claiming that a word generated by the self was on the list in the word list task. In addition, the DES is related to errors in autobiographical memory (Hyman and Billings, 1998) and word lists (Winograd *et al.*, 1998), indicating the possibility of a common underlying process, and Platt *et al.* (1998) reported a relation between consistency of autobiographical memory reports and errors in a word list task. Finally, there is a long tradition of generalizing from word list studies to a variety of memory tasks (see Roediger and McDermott, 1996), all dependent on the assumption that the underlying memory system functions the same regardless of the material (e.g. Banaji and Crowder, 1989).

In contrast, it may be that the tendency to make errors in the two tasks will be unrelated. Neisser (1982) argued that there may not be one underlying memory system that contributes to all tasks and suggested the need for ecologically valid memory research. Marian and Neisser (1997), in one of the few studies attempting to correlate performance across memory tasks, found that the number of words recalled

in a word list task was unrelated to individuals' claims of memory clarity for autobiographical memories. Hyman (in press) has argued that there are distinct forms of memory errors that reflect different underlying processes.

EXPERIMENT 1

Method

Participants

Ninety-four students enrolled in undergraduate psychology courses at Western Washington University participated for course credit. Eighteen did not complete the autobiographical memory manipulation (they did not answer the majority of questions after forming an image of their known event), and the data from those individuals was not used, leaving 76 participants. Not all participants answered all questions on all individual differences measures, but those scores were dropped only for the correlations concerning that measure.

Procedure

Participants were tested in small groups. After they signed a consent form, the participants completed the autobiographical memory task first. The goal was to assess the tendency to change source judgements prior to collecting individual difference measures so that the memory measure would not be biased by the predictor measures. Since the VVIQ requires verbal instructions from the experimenter, it was the next measure administered. The participants then responded to the remaining individual differences questionnaire and the order was counterbalanced. Each session lasted approximately one hour.

The autobiographical memory task involved the description, elaboration, and 'remember-know' evaluation of a childhood event (Hyman *et al.*, in press). The memory task was presented to the participants in a packet. The first page explained the definitions of childhood experiences that people remember and those people know occurred but do not remember. A remembered event was defined as one for which people have a personal memory that is accompanied by a conscious recollection of the time the event occurred. A known event was defined as one that individuals acknowledge happened, but for which all information about the event has been provided by external sources and not a personal memory of the event. External sources include photographs, family stories, videos, etc. What constitutes an event was determined by each participant. The instructions page was read to the participants and they were given an opportunity to ask questions. The remainder of the task was completed independently by each participant. On the next page, the participants were asked to provide a short description of a known event that occurred between the ages of two and ten. (In Hyman *et al.*, 1998, different groups described remembered events and known events, and the imagery manipulation was compared to control conditions. In this study, however, we were interested in individual differences related to creating false autobiographical memories, and thus we started with known events for all participants and asked all participants to form and describe images.) After providing a known event, participants were asked to imagine the event. On the following page, they provided additional information based on their image of the event: the location of the event, any objects present, other people present, their emotions at the time, and

any other perceptions and sensations experienced. On the final page, the definitions of 'remember' and 'know' were again stated, and participants were told that memories may be a combination of remember and know aspects. They then evaluated their recollection on a 7-point scale from 'know' (1) to 'remember' (7). Finally the participants rated their confidence in their 'remember-know' judgement from not confident at all (1) to most confident (7). Hyman *et al.* found that individuals given these imagery instructions rated their recollections significantly further from the 'know' end of the scale than control participants who did not imagine the event. We also rated the affective valence of the childhood experience as negative, neutral, or positive, and counted the number of words the participants wrote in response to the questions after they imagined the experience.

Materials

This study included eight individual differences measures: the Dissociative Experiences Scale (DES; Bernstein and Putnam, 1986), the Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973), the Measure of Ambiguity Tolerance (MAT; Norton, 1975), the Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1991), the Self-Efficacy Scale (SES; Sherer *et al.*, 1982), the Self-Righteousness Measure (SRM; Falbo and Belk, 1984), Locus of Control (LOC; Rotter, 1966), and the Myers-Briggs Personality Inventory (Myers and McCaulley, 1985).

The Dissociative Experiences Scale (Bernstein and Putnam, 1986; Carlson and Putnam, 1993) has individuals rate the frequency of various interruptions of thoughts, consciousness, memory, and personality. Respondents indicate the percentage of time they experience each of 28 different situations. The activities vary from driving some place and not remembering part or all of the trip to being told they sometimes do not recognize friends and family. A final average is calculated indicating frequency of dissociative experiences. For normal populations, the DES is positively skewed with most scores below 20. Bernstein and Putnam (1986) reported test-retest reliability of 0.84.

The VVIQ (Marks, 1973) is a measure of image clarity that asks individuals to rate how similar their visual images are to normal perception. The test includes 16 items that are grouped into four categories by base image. Thus individuals are asked to imagine a good friend and are then asked four questions about their image. Each item is rated once with eyes closed and once with eyes open. The vividness ratings are on 5-point scales from clear and like normal vision (1) to no image at all (5).

The Measure of Ambiguity Tolerance (Norton, 1975) examines the tendency to regard information that is vague, incomplete, uncertain, unstructured, or inconsistent as a source of psychological threat or discomfort. Individuals rate 61 items as true or false. Items cover a variety of content domains; for example, 'A problem has little attraction for me if I don't think it has a solution' and 'If I don't get the punch line of a joke, I don't feel right until I understand it'. The MAT is scored so that low scores represent higher tolerance of ambiguity. Norton reported internal reliability of 0.88 and test-retest reliability of 0.86.

The Balanced Inventory of Desirable Responding (Paulhus, 1991) measures how people create favourable impressions by enhancing positive traits and denying negative ones. The BIDR includes 40 test items such as: 'I don't care to know what other people think of me', and 'When my emotions are aroused, it biases my thinking'. Respondents

rate each item on a 7-point scale from not true (1) to very true (7). Paulhus reported internal consistency of 0.83. In addition, the BIDR is correlated with another measure of socially desirable responding; the Marlowe-Crowne SDS ($r = 0.71$).

The Self-Efficacy Scale (Sherer *et al.*, 1982) measures individuals' beliefs that they can successfully perform a variety of activities, including school, work, and social settings. There are 23 items, including: 'When I make plans, I am certain I can make them work' and 'I do not handle myself well in social gatherings'. All items are rated on 14-point scales from strongly disagree (1) to strongly agree (14).

Rotter's (1966) Locus of Control Scale is a measure of individuals' attributional style: the tendency to attribute the causes of outcomes to the self (internal LOC) or to things outside the self (external LOC). Items are presented as 29 pairs of statements and individuals are forced to select their preference in each pair. Most pairs force a choice between internal and external causes of outcomes. Respondents are given a point for each response corresponding to the external cause and thus higher scores reflect an external attributional style.

The Self-Righteousness Measure (Falbo and Belk, 1985) was designed to assess confidence and rigidity in an individual's belief system. Respondents rate their agreement to nine statements using a 7-point scale with 1 as strongly disagree and 7 as strongly agree. Example statements are 'People who disagree with me are wrong' and 'One person's opinions are as valid as the next'. Higher scores reflect greater self-righteousness.

The Myers-Briggs inventory (Myers and McCaulley, 1985) was created to gauge several personality and cognitive styles. It provides a measure of introversion and extroversion, and cognitive styles for perception (intuition versus sensing) and judgement (thinking versus feeling). Respondents are presented with 32 pairs of items and asked to indicate which they prefer and the strength of their preference on a 5-point scale.

Results and discussion

Overall, we found that the imagery manipulation was an effective method of changing the source-monitoring judgement for many, but not all, participants. Participants selected childhood events that they knew occurred, but did not remember. When they rated their recollection from know to remember after imagining the event, the mean rating was 2.21 ($SD = 1.36$). Hyman *et al.* (1998) found that individuals who imagined a known childhood experience rated their recollections similarly to our participants and differed from control participants who rated a known childhood experience they did not imagine. They argued that this indicates an overall change in source monitoring, from external source to at least claiming some personal memory.

We then looked for correlations to the remember/know rating and to the participants' confidence in their rating (see Table 1). Confidence was related to the 'remember-know' rating—people were less confident as their rating moved further from the 'know' end of the scale. This is not surprising since they had begun with an event they claimed to only know, not remember. Neither the affective valence of the event (scale from 1, negative, to 3, positive) nor the number of words participants wrote was related to either the 'remember-know' rating or confidence in the rating.

With respect to the measures of individual differences, only the DES was related to the 'remember-know' rating. This indicates a third measure of memory errors with

Table 1. Experiment 1: correlations to 'remember-know' judgement and confidence

Scale	'Remember-know' judgement	Confidence
Confidence	-0.314**	
Affect	0.004	-0.041
Number of Words	-0.060	-0.002
DES	0.261*	-0.029
DES-Absorption	0.314**	0.019
DES-Depersonalization	0.035	0.023
DES-Memory Failures	0.223	-0.088
VVIQ	0.172	0.002
MAT	0.052	-0.277*
BIDR	-0.084	-0.114
SES	-0.162	0.170
LOC	0.004	-0.019
SRM	-0.074	-0.024
MB-Introversion	-0.155	0.020
MB-Extraversion	0.165	-0.026
MB-Intuition	0.013	0.265*
MB-Sensing	-0.012	-0.265*
MB-Thinking	0.047	0.060
MB-Feeling	-0.051	-0.058

* $p < 0.05$; ** $p < 0.01$.

which the DES is correlated. Previously, Hyman and Billings (1998) found that the DES is related to the creation of false childhood memories and Winograd *et al.* (1998) found it is related to intrusions in a word list memory task. We also found that the subscale of absorption was reliably correlated with the 'remember-know' rating.

The MAT and two of the Myers-Briggs scales (intuition and sensing) were related to confidence. None of the other measures, including the affective valence of the event and the number of words participants wrote, was related. In all, this indicates the exploratory nature of this investigation. Only for the DES and the VVIQ was there previous research that justified interest in the scales. We used a variety of measures that could have been related to individuals likelihood of changing their source monitoring judgements. Unfortunately none of the measures aids in understanding why some individuals are more likely than others to make source monitoring errors for autobiographical memories.

In Experiment 2, we once again used the DES and we tried a different measure of imagery ability. In addition, we used two measures of memory errors. Few researchers have studied whether individuals who make errors in word list tasks are likely to make errors in autobiographical memory tasks (Marian and Neisser, 1997; Platt *et al.*, 1998). Thus we were interested in exploring multiple measures of memory.

EXPERIMENT 2

Method

Participants

One hundred and twenty-one students enrolled in undergraduate psychology courses at Western Washington University participated for class credit. One participant's data

were eliminated due to previous exposure to the autobiographical memory task. As in Experiment 1, the participants had to provide extra information in the autobiographical memory task after imagining the event to be included in the analysis. Of the 121 participants, 112 completed the autobiographical memory task. The average age for the remaining participants (24 males and 87 females; one participant failed to report their sex) was 20.02 ($SD = 2.87$).

Procedure and materials

Participants were tested in small groups. After agreeing to participate by signing a consent form, the participants completed the autobiographical event description and word list tasks. The order of these two methods to measure memory errors was counterbalanced across groups. Participants then responded to the individual differences questionnaires. The order of the questionnaires was also counterbalanced across the groups. Upon completion of the experiment, the participants received a debriefing statement.

Materials used in this study measured memory errors and individual differences. The memory errors were examined using two types of methodologies: the 'remember-know' evaluation of autobiographical memories (Hyman *et al.*, 1998) and recall and recognition of semantically related word lists (Deese, 1959; Roediger and McDermott, 1995). The individual differences tested were dissociation (DES; Bernstein and Putnam, 1986), and imagery abilities (IDQ; Paivio and Harshman, 1983).

The autobiographical memory task was the same as used in Experiment 1. Participants described a known childhood experience, imagined the event, and then rated their recollection on a scale running from 'know' to 'remember' and confidence in their 'remember-know' rating. When people imagine experiences they claim to know but not remember, some individuals claim some remembering of the experience (Hyman *et al.*, 1998).

The word list task was based on the work of Deese (1959) and Roediger and McDermott (1995). The participants listened to a recording of five semantically related word lists. Each list contained 15 words that were semantically related to one omitted word, called the critical lure. The lists were taken from Roediger and McDermott's (1995) study and had critical lures of chair, needle, sweet, mountain, and sleep. The five word lists were presented in a counterbalanced fashion across groups of participants. Immediately following each word list, the participants attempted to freely recall the words presented using a blank response sheet. The participants were instructed not to guess. After the presentation and recall of the word lists, the participants worked on a single sheet of basic mathematical problems that served as a 2-minute intervening task prior to the recognition task. The participants then completed a recognition task consisting of a list of 40 words. The list included the five critical item words, and 15 list words from the fourth, seventh, and tenth position on each list. These positions were chosen to avoid primacy and recency effects. The other 20 words were randomly selected from the other word lists created by Roediger and McDermott (1995). The participants identified each word as either old (presented on the word lists) or as new (not presented on the word lists). For each word judged old, the participants then rated the word as remembered or known. A remembered judgement was defined as having a vivid recollection of the word being presented. In contrast, a known judgement was defined as being sure the word was on the list, but not remembering its presentation. This task often results in false recall and recognition of the critical lure. At the end of

the task, the students were asked to write what they thought the purpose of the word list task was.

The Individual Differences Questionnaire (IDQ; Paivio and Harshman, 1983) measures verbal ability and imagery ability. This 86-item questionnaire was designed for true/false responses. Scoring for the subscales consists of counting the number of confirmatory responses for the statements respectively loading on each factor. Hiscock (1978) reported reliability coefficient alphas of 0.83 for the verbal section and 0.80 for the imagery section. We used only the imagery ability score and the subscales comprising it. The IDQ measures three aspects of imagery: the use of images to solve problems; the vividness of dreams, daydreams, and imagination; and the habitual use of imagery. Paivio and Harshman defined the use of images to solve problems factor as the tendency to deliberately employ mental images. The vividness of dreams, daydreams and imagination factor evaluates the clarity and realism of imagination. Higher scores on the habitual use of imagery subscale indicate that mental imagery is used often when problem solving, imagining events, remembering, and thinking. Sample items are 'I can easily picture moving objects in my mind' and 'My daydreams are something so vivid I feel as though I actually experience the scene'.

Results and discussion

The results are summarized in two sections. First, the results from the two memory methodologies and the relationships between them are presented. Then, the relationships between the memory measures and the individual differences measures are outlined. Omissions in data were deleted from the analyses in a pairwise fashion. There were no significant order effects for the presentation of the memory methodologies or the individual differences measures. In addition, the sex of the participants was not related to any variable in this study.

Memory methodologies

For the autobiographical memory task, the mean score on the 7-point know to remember scale was 2.36 ($SD = 1.37$). As in Experiment 1, participants' confidence in their responses on the 'know-remember' scale was negatively related to their responses on the 'know-remember' scale ($r = -0.241$, $p < 0.05$). In other words, participants whose scores deviated further from know were less confident in their responses.

Of the 112 participants, 20 guessed the purpose of the word lists. They indicated that the list words were semantically related, and that a closely related word was omitted. When compared with those who did not guess the purpose of the test, those who guessed had fewer critical lure and total word list intrusions (respectively $t = 2.267$, $p < 0.05$, $SE = 0.305$, and $t = 2.206$, $p < 0.05$, $SE = 0.457$), recalled fewer words ($t = 2.617$, $p = 0.01$, $SE = 1.48$), were less likely to claim as previously presented (i.e. 'old') both critical lures ($t = 2.690$, $p < 0.02$, $SE = 0.209$) and distracter words ($t = 3.287$, $p < 0.01$, $SE = 0.166$). Consequently, the data from the 92 non-guessing participants was used for analyses pertaining to the word list methodology. See Table 2 for means and standard deviations for accurate recall and recognition, and the recall and recognition of the critical lures, non-critical intrusions, total intrusions.

Table 2. Means and standard deviations for the word list variables

Word list variable	Mean	Standard deviation
Recall measures		
Critical lure intrusions	2.64	1.22
Other intrusions	1.22	1.24
Total intrusions	3.86	1.84
Accurate recall	43.99	6.01
Recognition measures		
Accurate recognition	12.83	1.66
Distractor words as old	0.81	0.99
Critical lures as old	4.30	1.00
Remember critical lures	2.67	1.45
Know critical lures	1.63	1.35

These measures are summed across the five word lists.

Table 3 presents correlations among the memory variables. Several relationships were found for the recall variables. Negative correlations were found between the total number of words accurately recalled and the number of non-critical intrusions and with the number of total intrusions. No relationship was found between the number of critical lures recalled and accurate recall or between critical lures and other intrusions. Participants able to correctly recall more presented words had fewer non-critical word intrusions and fewer total intrusions.

Within the recognition portion of the word list methodology, no relationships were found between claiming presented, distracter, or critical lures as old. As demanded by the task, however, positive relationships existed between both evaluating a critical lure as remembered or known and claiming that a critical lure was old. In addition, there was a strong relationship between the number of remember judgements and the number of known judgements of critical lures.

In comparing the recall and recognition variables, a few very straightforward relationships were found. A positive correlation existed between accurate recall and correctly claiming previously presented words as old. Additional positive correlations were found between claiming the critical lures as old and the number of critical lures recalled and with the number of total intrusions. Essentially individuals who recalled more words, recognized more; and those who made more errors in recall, made more in recognition. Performance appears to be consistent in the recall and recognition of word lists.

The relationships between the memory paradigms is of particular interest. These results are based on participants who successfully completed the 'remember-know' evaluation and did not guess the purpose of the word list methodology. In comparing the remember/know evaluations with the recall variables, no relationships were found. There was a trend toward a positive correlation for the 'know-remember' evaluation with accurate recall ($p < 0.10$). Confidence in the 'remember-know' evaluation was not related to any recall variables either. In comparing the 'remember-know' evaluation with the recognition variables, a positive correlation was found for the 'know-remember' evaluation and correctly claiming previously presented words as old. No relationships of any type were found between the 'remember-know' evaluation and errors made during recognition.

Table 3. Correlations among the memory measures

	RKE	CLI	OI	TI	AR	OO	DO	CLO	RCL
Remember-know evaluation (RKE)	–								
Recall measures									
Critical lure intrusions (CLI)	–0.165	–							
Other Intrusions (OI)	0.051	0.118	–						
Total Intrusions (TI)	–0.073	0.743	0.752	–					
Accurate recall (AR)	0.198	–0.145	–0.319**	–0.311**	–				
Recognition measures									
Old words as old (OO)	0.224*	–0.051	–0.074	–0.084	0.375*	–			
Distractor words as old (DO)	–0.136	–0.104	0.138	–0.025	–0.071	0.020	–		
Critical lures as old (CLO)	–0.175	0.405**	0.008	0.274*	–0.118	0.194	0.000	–	
Remember critical lures (RCL)	–0.130	0.169	–0.035	0.089	0.048	0.035	–0.083	0.434**	–
Know critical lures (KCL)	0.010	0.114	0.045	0.106	–0.148	0.116	0.099	0.254*	–0.756**

* $p < 0.05$, ** $p < 0.01$.

In summary, errors in the autobiographical memory task and the word list task were not related. Participants who gave higher 'know-remember' judgements of the autobiographical event were not more likely to falsely recall or recognize critical lures in word list methodology. Instead, errors reflected by the 'remember-know' evaluation were related to correct recognition of previously presented words as old. This supports the view that autobiographical memory errors and semantic intrusions are different (Freyd and Gleaves, 1996; Hyman, in press; Marian and Neisser, 1997; Neisser, 1982).

Relations of memory measures to dissociation and imagery

The results for the 'remember-know' evaluation and individual differences are based on those who completed the 'remember-know' evaluation properly, regardless of whether or not they guessed the purpose of the word list paradigm ($n = 112$). In contrast, the results for the word list paradigm and individual differences are based on data from participants who completed the 'remember-know' evaluation properly and did not guess the purpose of the word list methodology were considered ($n = 92$). The measures of individual differences included were the DES and its three subscales (memory failures, depersonalization, absorption) and the IDQ imagery score and two of its three subscales (habitual use of imagery, vividness of imagery). As the subscale for the use of imagery to solve problems is based on only two items, this subscale is not statistically stable (Thorndike, 1978) and was not included in further analyses.

The relationships of the individual differences measures with the 'remember-know' evaluation and variables provided by the word list methodology are presented in Table 4. The 'remember-know' evaluation was only related to one aspect of the individual differences examined: it was positively correlated to the DES subscale of depersonalization. This is not consistent with the results of Experiment 1 in which the full DES score and the absorption subscale were correlated with the 'remember-know' evaluation.

Table 4. Correlations between the memory measures and individual differences measures

	DES	MF	DP	ABS	IDQ	HUI	VDI
Remember-know evaluation (RKE)	0.113	0.134	0.197*	0.088	-0.018	-0.086	-0.033
Recall measures							
Critical lure intrusions (CLI)	-0.094	0.174	-0.140	-0.139	0.015	0.032	-0.004
Other intrusions (OI)	0.124	0.184	0.261*	0.132	-0.033	0.002	0.060
Total intrusions (TI)	0.020	0.239*	0.083	-0.003	-0.012	0.023	0.037
Accurate recall (AR)	-0.057	-0.123	-0.038	-0.058	0.090	-0.029	0.274*
Recognition measures							
Old words as old (OO)	0.113	0.066	0.101	0.086	0.132	0.138	0.055
Distractor words as old (DO)	0.025	0.144	0.084	-0.001	-0.117	-0.117	-0.078
Critical lures as old (CLO)	0.061	0.125	-0.039	0.048	0.192	0.219*	0.098
Remember critical lures (RCL)	0.044	0.035	-0.054	0.055	0.214*	0.121	0.250*
Know critical lures (KCL)	0.007	0.062	0.033	-0.009	-0.094	0.026	-0.200

* $p < 0.05$. ** $p < 0.01$.

DES - Dissociative Experiences Scale; MF - Memory Failures Subscale of DES; DP - Depersonalization Subscale of DES; ABS - Absorption Subscale of DES; IDQ - Imagery Score of IDQ; HUI - Habitual Use of Imagery Subscale of IDQ; VDI - Vividness of Dream and Imagery Subscale of IDQ.

For the recall portion of the word list task, there were few reliable correlations. Accurate recall was positively related to the IDQ imagery subscale of vividness of dreams, daydreams and imagery, the number of total intrusions during recall was positively correlated to the DES subscale of memory failures, and the number of non-critical intrusions was positively correlated with depersonalization.

None of the variables from the recognition portion of the word list methodology were related to dissociative factors. Two of the recognition variables were, however, related to imagery factors. The number of critical lures claimed as old was positively related to the habitual use of imagery. Critical lures claimed to be remembered as old were positively correlated to habitual use of imagery, and the full IDQ imagery score. Individuals who claimed more imagery use and vividness were more likely to falsely recognize the critical lure and claim to remember it.

In sum, we found different patterns of correlations of the two memory tasks with the individual differences measures. Although both the change in source judgement for the autobiographical memory task and intrusions in the word list task were correlated with aspects of the DES, only errors in the word list recognition were related to the imagery measures.

DISCUSSION

Errors in autobiographical memory were not related to the number of semantic intrusions in remembering word lists. There are several possible explanations. One is that performance on word lists and other simple memory tasks is not representative of more complex memory tasks, such as autobiographical remembering (Freyd and Gleaves, 1996; Hyman, in press; Neisser, 1982). In keeping with this finding, Marian and Neisser (1997) found no relationship between the amount of recall on a word list task and the reported clarity and completeness of autobiographical memories. In contrast, however, Platt *et al.* (1998) found that consistency in autobiographical memory reports is related to errors in word list memory.

It may be that the basic memory functions are somehow obscured by the complexity of autobiographical memory tasks and can only be studied in carefully controlled laboratory settings (Banaji and Crowder, 1989). But this only necessitates the investigation of memory in ecologically valid contexts in order to understand how memory works in these situations and to make generalization possible (Neisser, 1982, 1991).

Rather than one memory process being obscured in complex tasks, the difference between the tasks may be that the errors are generated in different fashions—not all memory errors reflect the same underlying processes (Hyman, in press). The word list intrusions may occur via the semantic activation of related concepts. In contrast, some autobiographical memory errors, like false childhood memories, require the construction of a memory based on suggestions and self-schemata. Other autobiographical memory errors may not be dependent on suggestions, like the changes Platt and his colleagues reported, and thus may correlate with word list performance.

In addition, the difference may be due to the definition for the term 'event' in each method. In word lists, hearing each word is usually considered an event. In the autobiographical memory task an event was a childhood experience. The nature of the experience was determined by each participant and ranged from minutes (climbing

out on a roof as a toddler) to several days (a vacation to Disneyland) to months (escaping from Vietnam over a two-month period). A single word is not comparable to any of these autobiographical events in time scale, complexity, or self-involvement. This illustrates Freyd and Gleaves' (1996) concern that the event of remembering a critical lure in a word list task is not generalizable to falsely remembering a childhood experience. Although Tulving (1983) classified both word lists and autobiographical memory as episodic memory, there may be a need for subcategories.

Another possible reason for the distinction may be that the autobiographical memory task does not reflect a memory error, but is instead an acquiescence to social demands without any corresponding memory change. It is, however, unlikely that the 'remember-know' judgement reflects social pressure since there was no relationship to socially desirable responding in Experiment 1. In addition, Hyman and Billings (1998) found no link between the creation of a false childhood memory and a different measure of socially desirable responding. Instead, as Hyman *et al.* (1998) demonstrated, the 'remember-know' evaluation reflects changes in source monitoring judgements in response to the creation of more complete images.

Of course, the nature of the source monitoring error is not the same in the two tasks. In the 'remember-know' evaluation of autobiographical memory, the error is attributing to personal memory information that previously had been attributed to external sources. Errors in source monitoring in the word list method occur during recall and recognition. These errors involved claiming that a word was provided by the external source and is now being remembered, when the source of the intrusion was actually internal generation. While both can be considered source monitoring errors, the nature of the attribution error is quite different. In addition, the 'know' judgement in the word lists and autobiographical memory do not reflect the same concept. In word lists, 'know' means a strong feeling of familiarity without recollection of hearing or seeing the word. In autobiographical memory, 'know' means information about the event is derived from external sources (e.g. pictures, family stories, etc.). This may also account for why Platt *et al.* found a relationship of their autobiographical task to a word list task—their task may not involve source errors if the information that people report is actually remembered material. Thus the nature of the source judgement may also explain why some memory tasks are unrelated.

One final issue to consider is that the two measures may not be reliable measures of individual differences in the tendency to make memory errors. The autobiographical memory task is a measure of memory based on one experience and the word list task is based on only a few word lists. The fact that both tasks appear to be consistently related to other measures of individual differences argues that the measures are at least somewhat reliable. Nonetheless, further research is needed to see if these measures are good measures of memory ability.

We found additional evidence that dissociation is related to the creation of memory errors. In Experiment 1, the full DES score and the subscale of absorption were related to changes in source judgements for autobiographical memory. In Experiment 2, the DES subscale of depersonalization was related to source errors in autobiographical memory and to the number of total intrusions in the word list task. This concurs with Hyman and Billings' (1998) finding that the full DES and, as reported here, all subscales were related to the creation of false childhood memories. In addition, Winograd *et al.* (1998) found that some aspects of the DES were related to intrusions in word list memory. Unfortunately, the exact pattern of correlations is not consistent

across these studies and Platt and his colleagues reported that the DES was not related to performance on a similar word list task or to consistency in autobiographical memory when no suggestive pressures had been applied. It may be that the DES reflects individual differences in source monitoring criteria (Winograd *et al.*, 1998) or the tendency to integrate self-knowledge across a variety of sources (Hyman and Billings, 1998). Clearly further examination of dissociative tendencies in relation to memory errors and other cognitive processes is needed.

We found no relationship of changes in source judgement for autobiographical memory to individual differences in mental imagery. We did find, however, that for the word list task, the vividness of imagery was related to both accurate recall and remember judgements of critical lures. Winograd *et al.* (1998), using a different measure of imagery vividness, also found that individual differences in imagery was related to remember judgements for word intrusions. Further, Hyman and Billings (1998) found that imagery vividness was related to the creation of false childhood memories.

In this case, the pattern of correlations may tell us something about the processes involved in the different memory tasks. The distinction may be related to the tendency to form images in tasks when that is not required. In the word list and false childhood memory tasks, individuals are not typically required to form images. Thus individual differences may determine who forms vivid images that later lead to source monitoring errors. In contrast, the 'remember-know' methodology for autobiographical memory requires all participants to form images. In this case, there may be less opportunity for individual differences to be expressed.

In conclusion, we found that memory errors in simple laboratory memory tasks may not be generalizable to more naturalistic memory tasks. The errors generated may reflect different memory processes. In addition, there may not be some underlying tendency to make memory errors that is expressed in all memory contexts. It may be risky to predict someone's performance in everyday memory tasks from performance on simple lab tasks.

Nonetheless, an intricate web of relationships exists among memory errors and measures of individual differences. In many contexts, individual differences in imagery are related to memory errors. In addition, dissociative tendencies are related to a variety of memory errors. Thus there may be some reason, beyond chance variation, why some individuals are more likely to create memory errors in some contexts.

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