Effects of Misinformation on Memory Recall

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Abstract

Misinformation has been widely investigated as a factor influencing memory. This study examined whether the presentation of misinformation affects how individuals recall items from a word list by challenging the Deese–Roediger–McDermott paradigm. Participants consisted of 63 men and women between 18 to 81 years old. The study involved the presentation of six lists of words each consisting of 15 items taken from a study by Stadler et al. (1999). Once presented with the list, participants were asked to read a narrative story and then to immediately perform a free-recall test. Data were gathered using half-page-sized packets designed specifically for each participant group. A one-way analysis of variance was used to analyze the results of the primary study. The secondary study of the association between age and memory recall was analyzed using a Pearson's correlation. Findings showed a significant negative correlation between age and memory recall of presented items. The key finding is that, regardless of their group or age, participants tended to remember on average the same number of critical target words, presented words, and nonpresented words. The findings did not support the hypothesis that older adults would score lower on a recall test. On the basis of these results, one can conclude that how information is presented has a major effect on recall.

Keywords: misinformation, memory, recall

Commented [A1]: An abstract and keywords are not required for student papers. Only include an abstract and keywords in your student paper if requested by your instructor for the assignment.

Effects of Misinformation on Memory Recall

Memory can be defined as a system that senses, organizes, stores, and retrieves information (The Human Memory, 2019). According to the *APA Dictionary of Psychology* (American Psychological Association, n.d.), memory can also be a representation of past events and a way of encoding and processing those events. There are three main types of memory characterized by the importance of the information received. The first type is *sensory memory*. In sensory memory, information is first presented through our senses. It is the threshold between what we perceive and what we choose to remember (Roediger & DeSoto, 2015). The second type is *short-term memory*. In short-term memory, information is moved from sensory memory and is analyzed as being useful. The information is stored for approximately 30 s. After one decides that the given information is important, it is then encoded and stored within the last type—*long-term memory*, where it is held as an official memory.

Effects on Memory

Many factors can affect memory. One factor is the encoding of memory through schemas. A *schema* can be defined as a structure of knowledge in the brain that is used to store information (Wagoner, 2013). Individuals use schemas to create many ways of encoding information to fit already established memories. Schemas not only allow individuals to store memories but also can lead them to reconstruct and alter memories that are processed.

Although schemas are beneficial when processing information, many individuals have a difficult time with those processes. Age has an impact on the difficulty of encoding information. Sahakyan (2019) found that older adults have impaired encoding processes compared with younger adults. This may be due to age-related differences in internal locus of control (LOC). Individuals with more internal LOC tend to believe that effort, reliability in oneself, and

individual ability determine the outcome of a task and performance on it (Amrhein et al., 1999). Older adults tend to have lower internal LOC and to display poorer performance on cognitive and memory tasks compared with young adults (Riggs et al., 1997). A reason posited for older adults' lower internal LOC is the prevalence of negative stereotypes about cognitive ability for their age group (Beaudoin & Desrichard, 2011; Strickland-Hughes et al., 2017). These negative outlooks on older adults can affect their memory performance. As stated previously, older adults tend to have lower internal LOC that affects their self-efficacy and how they view their abilities and outcomes. Pairing that tendency with negative stereotypes about older adults' cognitive ability supports the hypothesis that older adults will perform at a lower level on a memory task compared with younger adults.

Older adults may also use different strategies for memory encoding and retrieval compared to younger adults. According to a study on the role of retrieval by McKinley et al. (2019), individuals learn and encode memory through association. The strategy of learning and memorizing through association is characterized by actively pairing information based on similarities and relations to each other, also known as a *reminding effect* (McKinley et al., 2019). Many individuals, not only older adults, use associative learning as a means for remembering information on recall and recognition tests by using context clues (Sahakyan, 2019).

Recall testing requires actively using schemas and associations to retrieve information from memory. According to a study by Otani and Hodge (1991), the types of schemas that affect performance on recall tests are relational processing and item-specific processing. *Relational processing* is characterized as focusing on features similar to other items in a word list. *Item-specific processing* emphasizes the individual items in a word list. During recall tests, there may be issues not only with the accuracy of recalling items from a list but also a phenomenon of

recalling items that were never presented. This phenomenon is known as the Deese–Roediger–McDermott (DRM) paradigm (Deese, 1959).

Memory Paradigms

One of the paradigms that will be tested in the current study is the DRM paradigm. The *DRM paradigm*, established by Deese (1959) and later extended by Roediger and McDermott (1995), shows the relationship between the false memory of nonpresented items (critical words) as being accounted for by a presented word list during retrieval tasks. In experiments conducted to test this paradigm, researchers used an established word list with items that had associated qualities and asked participants to remember as many words as possible from that list to be later tested during a free-recall task. During the free recall, the researchers found that individuals confidently remembered words that were never presented in the list. These words were coined "critical target words" or "extra-list intrusions" (Deese, 1959; Roediger & McDermott, 1995). The researchers assumed that because the falsely memorized words had some form of association with the items presented, they were seen as being initially presented on the list. This assumption shows that simply encoding information through associative factors can predict the likelihood of remembering critical target words during memory retrieval (Deese, 1959).

With free-recall tasks, context and internal stimuli play a role in cueing retrieval (Sahakyan, 2019). For retrieval on recall testing to activate, cues from established memories and schemas must be used, whereas in recognition testing, external cues and stimuli can help with retrieval. Individuals performing recall tasks tend to cognitively create possible responses that are highly associated with the presented items in a word list and to label these false responses with the presented items (May & Sande, 1982). While participating in memory tasks, individuals not only recognized the false memories but also had high confidence and certainty that the

critical words were presented even when they were not (Roediger & DeSoto, 2015). In Otani and Hodge's (1991) study on individuals' feeling of knowing, many reported confidence in their cognitive abilities, but factors such as processing strategies and frequency of the words used had an effect on memorizing and retrieving both recalled and unrecalled items. Much of the content within false memories stemmed from presented information (Lampinen et al., 1999).

Memory can be affected not only by associative norms. Many false memories can be produced when inferences about events are confused with actual perceptions, thus characterizing the source monitoring framework (Lampinen et al., 1999). The *source monitoring framework* posits that individuals typically use a source monitoring process to create attributions about where (through what source and under what circumstances) their memories, information, and beliefs originated (Johnson et al., 1993). This means that the way people retrieve memories, whether they be true or false, is affected by how they interpret the source.

In relation to source attributions, it is important to consider how age and performance on memory tasks correlate with the source and modality of the information that is given. As Amrhein et al. (1999) note in their paper on the concept of LOC, researchers have found that older adults have poorer performance on retrieval tasks compared with younger adults not only because of differences in LOC but also because of their greater cognitive sensitivity to outside stimuli. Hasher and Zacks's (1988) research on inhibition and working memory supports the claim that older adults' sensitivity to outside stimuli and intrusive internal thoughts causes them to have difficulty focusing on memory tasks, which can lead to their being more susceptible to errors in recall. In contrast, these findings may imply that younger adults have less difficulty performing memory tasks when an external stimulus is present.

Another paradigm that occurs with memory is the *serial position effect*. This is the tendency for individuals to remember information that was presented or events that occurred primarily (primacy effect) and lastly (recency effect). With the serial position effect, individuals performing recall tests try to remember a great number of items presented in a word list by constantly rehearsing the first items presented up through the last items, which become more recent to their memory bank (Ward & Tan, 2019). According to Ward and Tan (2019), items that are received in recall tasks enter a rehearsal buffer zone, and with every new input of items, many of the previous items become lost and replaced with critical words. The effectiveness of memorizing items correlates with the length of the word list. Roediger and McDermott (1995) theorized that the longer the word list, the larger the increase in the rate of recalling critical words. The length of the word list also affects the serial position effect. Recalling items on a short list provides adequate opportunity for rehearing the information; in contrast, when the length of the list becomes longer, individuals may have to shift their focus to new items to rehearse, causing them to displace previously perceived items (Ward & Tan, 2019).

Misinformation

The *misinformation effect* is the tendency of a person's memory of a particular event to become altered through the presentation of false information (Zhu et al., 2013). This effect was researched in many studies by Loftus and colleagues. In Loftus et al.'s (1978) study, the researchers modeled the process of eyewitness testimony by having participants watch a video about an automobile accident and then asking them to read a story or answer misleading questions about it. The results showed that the misinformation presented through the stories and misleading questions affected participants' initial memories. Experiments conducted on the misinformation effect have continued to demonstrate that misleading information can lead us to

reconstruct initial memories so that we later believe them to be facts, even when they never occurred (Roediger & DeSoto, 2015). Researchers have also shown that the effects of misinformation can be reduced through the way the misinformation is presented via an "implied social source" (Huff et al., 2016). This source can be represented as a story or a visual aid as compared to another person physically presenting the misinformation. A study by Huff et al. (2016) on misinformation showed that participants may be more likely to accept misinformation as being accurate if the source seems credible. This belief in credibility came from participants' biases about the experimenter, thus strongly increasing the effect.

Present Study

The purpose of the present study was to analyze how the presence of misinformation affects the DRM paradigm and the rate of critical words remembered during free-recall testing. In the study, I presented misinformation to participants through a short story directly following the presentation of a word list to analyze the story's effects on reconstructing memory. I hypothesized that the presentation of misinformation through a narrative story directly following a given word list would cause an increase in the rate of memorizing nonpresented critical target words during a free-recall test. I also hypothesized that because of the absence of delay within the memory testing, the group that did not read the story immediately following presentation of a word list would score higher on recall of presented items from the list. Last, I hypothesized that age-related differences would correlate with the rate of recalled items because older adults would recall more nonpresented critical items than would younger adults.

Method

Participants

Participants were 63 family members, friends, and coworkers and consisted of both men and women of all races aged 18 years and older. The average age of participants was 39 years (*SD* = 7.8).

Design

For the primary study, I used an experimental between-subjects multigroup design by randomly assigning participants to each group. The independent variable (misinformation) consisted of three levels: misinformation presented group, misinformation not presented group (narrative group), and immediate recall group (control group). The dependent variable was recall, and it was operationally defined as the rate of critical target words recalled; presented words recalled; and nonpresented, noncritical words recalled.

The secondary study was a correlational analysis of the relation between the age of participants and the rate of words recalled.

Materials

Six lists of words consisting of 15 items each taken from the study by Stadler et al. (1999) were used in the study. The word lists are shown in Appendix A. I also used narratives within the experiment (see Appendix B). The narratives consisted of items from their respective word lists. I pulled two words from the beginning of the list (Positions 1 and 2), two from the middle (Positions 5 and 10), and two from the end (Positions 14 and 15). Each narrative consisted of three sentences and had between 30 to 35 words. For the free-recall test, I provided participants with a packet containing blank sheets of papers to record the answers. The first page of the packet was a brief demographic questionnaire that asked for the participant's age and sex.

Procedure

I first informed participants that they would be taking a memory test and had them review and sign a consent form. I began the experiment by reading a word list at a rate of one word per 2 s (Roediger & McDermott, 1995). After presentation of the word list, participants in the narrative group were given 60 s to read a narrative unrelated to their word list. Participants in the misinformation group were also given 60 s to read a narrative; however, their narrative included critical target words that were not presented in the word list. After the 60 s, both groups of participants were instructed to perform a free-recall test by writing down their words on the blank sheet of paper provided in the packet. The control group was given a recall test immediately after the word list was presented (with no narrative in between). This process was repeated for all six word lists. All participants were given a total of 90 s for the free-recall tests. The full experiment took approximately 20 min to complete.

Results

Misinformation and Memory Recall

I analyzed the data using a one-way analysis of variance set at a .05 alpha level. The narrative group recalled an average of 3.57 (*SD* = 1.69) critical target words; 43.48 (*SD* = 11.37) presented words; and 3.90 (*SD* = 3.06) nonpresented, noncritical words. The misinformation group recalled an average of 4.43 (*SD* = 1.83) critical target words; 45.35 (*SD* = 10.99) presented words; and 3.30 (*SD* = 3.05) nonpresented, noncritical words. The control group recalled an average of 3.42 (*SD* = 1.64) critical target words; 45.32 (*SD* = 12.43) presented words; and 2.53 (*SD* = 3.82) nonpresented, noncritical words. There was no significant group difference in the number of critical target words recalled, $F(2, 60) = 2.17$, $p = .123$; number of presented words recalled, $F(2, 60) = 0.18$, $p = .835$; or number of nonpresented words recalled, $F(2, 60) = 0.87$, $p = .424$.

Age and Recall

A Pearson's correlation set at a .05 alpha level was used to analyze the association between age and recall. There was not a significant correlation between age and the number of critical target words recalled ($p = .211$). There was a significant negative correlation between age and the number of presented words recalled ($r = -0.39$, $n = 63$, $p = .001$). There was not a significant correlation between age and the number of nonpresented words recalled ($p = .933$).

Discussion

In this study, I investigated whether the presentation of misinformation affected the DRM paradigm and the rate of critical target words remembered during a series of free-recall tests. I hypothesized that presenting misinformation via a narrative story directly following a word list would cause an increase in the rate of memorizing nonpresented target words during the recall test.

This hypothesis was not supported by the findings. Participants recalled the same number of critical target words regardless of testing group (narrative group, misinformation group, and control group). There was also no significant difference in scores for recall of presented words between groups. Overall, participants were not affected by the presentation of misinformation or by which form of the test they were given.

I also investigated the association between age and memory recall, hypothesizing that older adults would score lower on a free-recall test compared with younger adults. Again, there was no evidence of a correlation between age and the number of critical target words recalled, but there was a significant negative correlation between age group and how many presented words were remembered.

The results of this study contradict previous literature showing an association between age and memory recall. The results showed no evidence that older adults score lower on memory tasks based on the amount of critical target words remembered. Sahakyan (2019) theorized that older adults have more difficulty with memory tasks and remember more inaccurate information because aging disrupts the processes involved with encoding and retrieving memories. This study showed that, on average, participants scored approximately the same on the recall test regardless of age. It could be that the circumstances involved with testing in this study such as the duration to read the narrative, time given for free recall, and time between reading words on the lists allowed older individuals, who previously scored lower on memory recall, to use the circumstances to their benefit. I believe that the participants were given too much time between tasks, which allowed room for rehearsal of the narratives and caused them to lose focus after recalling the word list items. This both benefited and disadvantaged all participants because they began to write words they were not sure had been presented.

The findings from the Roediger and McDermott (1995) study were supported by my findings. According to the DRM paradigm, individuals are prone to remember critical target words that were not presented in word lists based on the length of the list and the association between the words. Many participants in this study remembered the anticipated critical target words and reported that the schematic association between the words and other items on the list influenced them to believe that a word had been presented. I also account for the influence that the narrative stories that included misinformation (critical target words) had on memory. Participants may have been more likely to believe the critical target words were presented because of the words' appearance within the narratives. Individuals tend to pay more attention and accept misinformation when it comes from a seemingly credible source (Huff et al., 2016).

In many instances, participants caught on to the items from the word lists appearing within the narratives, which led them to believe and have confidence in the items and mistakenly recall the critical target words. This confidence in their memory can also be attributed to the feeling of knowing. According to Otani and Hodge (1991), feeling of knowing is characterized by one's confidence that the information that is being perceived is correctly stored within one's memory. Many participants noted during and after the free-recall test that they had confidence in many of the words they recalled, whether they were critical target words, presented words, or nonpresented words.

This study has limitations that may have affected the results. One limitation was the occurrence of a global pandemic (the COVID-19 virus) during the time of experimentation. The pandemic affected the recruitment of participants and the study's final sample size. Because of a smaller than estimated sample size (estimated at 96 participants), I am not able to generalize the results nor to determine how much variance there was and whether there are major differences between the testing groups.

Another limitation was due to cognitive factors among the participants. These factors included general frustration and stress. Many participants reported being frustrated with the repetitive process of the study as well as the time between steps (reading the narrative and word recall). The overall stress level of participants may have affected how they scored on testing as those who reported being stressed or frustrated tended to lose focus and concentration on the task and focus more on their feelings. Stress can play a major role in memory retrieval. According to research, stress causes the secretion of hormones that increase cortisol levels within the brain, which in turn affects the brain's neural and chemical ability to consolidate and retrieve memory (Roozendaal, 2002).

In conclusion, the current study focused on the effects of misinformation on memory by testing the DRM paradigm. Future researchers should expand on this study by testing and analyzing how the element of delay affects recall. Because time was suspected to affect how participants performed, it would be important to examine how time affects the DRM paradigm, whether it being a longer break before performing the free-recall test or a comparison with immediate free-recall tests. Also, it would be important to study how using images to present list items affects accuracy on a recall test. This concept would be valuable in studying schemas and how associative memory works during imagery encoding, another concept within the DRM paradigm.

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Appendix A

Critical Targets In List Items 1 to 15

Sleep: bed, rest, awake, tired, dream, wake, snooze, blanket, doze, slumber, snore, nap, peace, yawn, drowsy

Sweet: sour, candy, sugar, bitter, good, taste, tooth, nice, honey, soda, chocolate, heart, cake, tart, pie

Doctor: nurse, sick, lawyer, medicine, health, hospital, dentist, physician, ill, patient, office, stethoscope, surgeon, clinic, cure

Chair: table, sit, legs, seat, couch, desk, recliner, sofa, wood, cushion, swivel, stool, sitting, rocking, bench

Window: door, glass, pane, shade, ledge, sill, house, open, curtain, frame, view, breeze, sash, screen, shutter

Smell: nose, breathe, sniff, aroma, hear, see, nostril, whiff, scent, reek, stench, fragrance, perfume, salts, rose

Appendix B

Narratives

Narratives (Narrative Group)

1. Olivia needs to rest so she climbs into bed. After a big yawn she covers up with a blanket and becomes drowsy. A few minutes later she is having a dream.
2. Olivia enjoys the tart flavor of sour candy. She decides to bake a pie for her friend who does not enjoy the same tastes as herself. She hopes the pie will be good.
3. Olivia is a nurse at Bedrock Hospital. She works alongside others to cure sick patients with tuberculosis improving their overall health. She also volunteers at a local clinic in the city.
4. Olivia wants to purchase a rocking bench made of wood to sit on her front porch. She also wants to purchase cushions for it. She already has a table there.
5. Olivia is spring cleaning by scrubbing the glass in her house. She first removes the shutters and the screens. She also washes the curtains and wipes down all the doors.
6. Olivia likes the candle scents at the local shop. She breathes through her nose and gets a whiff of the rose from a floral candle. She notices bath salts at the shop as well.

Narratives (Misinformation Group, With Critical Target Words Bolded)

1. Olivia needs to rest so she climbs into **bed** to sleep. After a big yawn she covers up with a blanket and becomes drowsy. A few minutes later she is having a dream.
2. Olivia enjoys the tart flavor of sour candy. She decides to bake a **sweet** pie for her friend who does not enjoy the same tastes as herself. She hopes the pie will be good.

3. Olivia is a nurse at Bedrock Hospital. She works alongside **doctors** to cure sick patients with tuberculosis improving their overall health. She also volunteers at a local clinic in the city.
4. Olivia wants to purchase a rocking **chair** made of wood to sit on her front porch. She also wants to purchase cushions for it. She already has a table and bench there.
5. Olivia is spring cleaning by scrubbing the glass **windows** in her house. She first removes the shutters and the screens. She also washes the curtains and wipes down all the doors.
6. Olivia likes to **smell** the candle scents at the local shop. She breathes through her nose and gets a whiff of rose from a floral candle. She notices bath salts at the shop as well.