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The Effects of Processing Tasks on False Memories

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THE EFFECTS OF PROCESSING TASKS ON FALSE MEMORIES

by

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ABSTRACT

THE EFFECTS OF PROCESSING TASKS ON FALSE MEMORIES

The purpose of the present study was to examine the effects that three different processing tasks had on the rate of false memories. Participants were randomly assigned into a story condition, survival condition, or a pleasantness condition. Using a word list that had three groups of ten words each connected to a nonpresented critical word, participants were asked to process the words using instructions based on their given condition. Processing occurred through written sentences, which was then followed by a short mathematical distraction test. Participants were then given time to recall all of the words presented on the list by writing them down on a sheet of paper. We predicted that deeper processing would result in greater levels of false memory, however, our results did not fully corroborate past findings or our predictions. More specifically, false memory rates were statistically equivalent across all three processing conditions. While the narrative story condition produced the best recall rate for studied words, the survival condition showed an advantage by producing the lowest number of intrusions.

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INTRODUCTION

Psychologists have long been fascinated by the methods utilized and occurrences in which the brain processes information. Unsurprisingly then, the process of memorization and learning is not a new area of investigation within the psychological field. Numerous studies have examined the effects that different processing tasks have on an individual's memory. In 1995, false memories were described as the remembrance of events that either did not occur or occurred differently in actuality compared to one's memory (Roediger & McDermott, 1995). Some key research has looked into the likes of survival processing, narrative storytelling processing, and pleasantness processing tasks. While this work has granted the psychological community more insight, more research is required to understand how such processing tasks differentially influence false memory rates. In this study, all three of these methods were further examined and compared to further understand what prompts the human mind to remember stimuli or create false memories that the individual believes actually occurred.

LITERATURE REVIEW

In the 1960s, many researchers studied memory and its formation through serial learning. Defined by Kao (2020), serial learning refers to both the ability to learn a list in order and the relationships between items on the given list. In 1969, Bower and Clark, in "Narrative Stories as Mediators for Serial Learning," wanted to examine the effectiveness of the "chaining" method on memory. The study evaluated the effect that creating a short narrative story would have on retention compared to simple memorization in a situation that could be conducive to this method's efficiency.

The study was conducted with 24 undergraduate students who were split into two groups. Each student was given 12 lists of words, one at a time, consisting of 10 concrete nouns. The first group, the narrative subjects, were told that creating a story including the words is a good way to learn a list of words. They were given a list and told they could take as much time as needed to create a meaningful story. For every narrative subject tested, a control subject was given the lists of words in the same order with the same allotted time. The control group was simply told to study and learn the list. Both groups were instructed to immediately recall the words after each list. After the twelfth list was learned and recalled, they were then asked to recall the first list and all subsequent lists, with a cue of the first word on each list.

Though both groups were extremely proficient in the immediate recall of each list, the results show staggering differences between the narrative and control groups for the final longer-term recall of the lists. The authors believe that this evidence is indicative of an effect of thematic organization on memory retention. They hypothesize that it may be due to an effect during the learning process that connects the words to a single theme that is easily recalled with the prompt of the list's first word. The researchers found that for the narrative group, shorter vs.

longer study times did not yield a significant difference, while the control group's recall was greatly affected by the study time allotted. They also reported that the time taken to create the story and learn the list shortened over the first four lists, which may be due to an increased familiarity with the task.

In 1995, Roediger and McDermott conducted a study to further explore false memory and the circumstances in which it occurs. Using previous research, specifically a 1959 study of free recall of studied word lists (Deese, 1959), the researchers, Roediger and McDermott, had a base understanding that they wanted to replicate and expand upon. To do this, the researchers conducted two separate experiments. The first of which explored false recall and false recollection and the confidence in those responses regarding the critical words that were related to but not included on the studied lists. Experiment 2 was conducted to further generalize the first experiment by using more lists that were purposely designed to produce intrusions, in addition to words that were neither presented nor critical, to examine free recall for each type of word. They also wanted to examine the effects of an initial false recall on later recognition of those same words.

The first experiment was a replication of Deese's (1959) prior experiment. It used six of his lists that produced the highest rate of error. 36 undergraduates heard and recalled the lists and then were given a recognition test, comprised of studied and non-studied words that included the critical words purposefully left off of the original studied list. Those critical words included c*hair, mountain, needle, rough, sleep,* and *sweet*. To originally generate the lists surrounding these words, the researchers collected words that were known to be closely associated with each critical word. The later recognition test was comprised of 42 words, with three types of non-studied items: six of the critical words, 12 words with a weak relation to the lists, and 12 words

that were unrelated to any studied word. Roediger and McDermott conducted the test sequence in blocks, seven total, with the order corresponding to the order in which the students learned the lists.

The research was conducted during the student's class session, where they were told that they would be asked to listen to lists of words and then be immediately tested after listening to each list by writing them down in an exam book. As per the study's usual instruction, the students were asked to write the last few words first and then recall the words in any order. Additionally, they were told to be "reasonably confident" in any word that they wrote down but also to write down all the words they could remember. They had two and a half minutes to recall each list. After a brief break, they were given the recognition tests, on which they would see a list of words and have to rate their confidence on a four-point scale concerning whether or not each word was on the list that they studied earlier. They had no time limit for this test.

In the first experiment's recall test results, the researchers found that there was a much higher rate of critical word intrusions than other intrusions. This indicates that the students did not guess randomly. For the recognition test, the authors believe that the results were affected by the prior recall test. They found that the false recognition rate was very low for the unrelated lures, higher for weakly related lures, and extremely high, compared to past studies, for the critical words. More than half the time, the students were confident that the critical words had actually been studied, whereas they were accurate in identifying that the non-critical lures were not studied, and were accurate in recognizing the studied words. Surprisingly, participants were just as likely to falsely recognize seeing critical words as actual words studied on the list.

The first experiment confirmed Deese's prior observations of a high rate of false recall in this situation. Because there was a low rate of general intrusions, the high rate of false recall is

not due to wild guesses. The further use of a recognition test showed that the unpresented critical words were recognized at about the same rate as the studied items. This, in addition to the fact that the students were confident in the appearance of the critical words more than half the time, gives credence to this method for examining false memories.

The second study was conducted with four goals in mind. The first aim was to replicate and generalize the first experiment using different materials. Second, the authors wanted to study the effects that an additional recognition test would have on recall. Third, they wanted to explore the false alarms for the critical words when the mentioned critical word had yet to be presented. Most importantly, the final goal was to understand the student's judgments and mental processes, their phenomenological experience, when recognizing the words that had not actually been presented.

The study was conducted with three conditions in a within-subjects design. There was a total of 24 lists that were randomly divided into three different sets, each used equally across conditions. Thirty students were presented with sixteen lists through the use of a tape recorder. After half of the lists had been presented, students performed immediate free recall tests, while after the other half, they performed math problems. The students were given two minutes to perform their respective tasks. Following the conclusion of all 16 lists, the students had a recognition test composed of words from the sixteen studied lists and words from eight similar lists not previously studied. They determined a student's mental process by asking the students to differentiate their state of awareness about the past between "remembering" that an item had been presented and "knowing" if a word was originally studied from a list. They were to indicate this by writing an *R* or *K* next to the word on the recognition test. This was done in addition to asking whether or not they recognized a word from a previous list. The recognition test consisted

of 96 randomly ordered words, 48 of which were not studied during the encoding phase of the experiment. These were made up of 24 critical words from all lists and 24 words from the eight non-studied lists. Of the 48 studied words, three words were selected from each of the 16 presented lists.

In this experiment, they found the students recalled the critical word at a higher rate than in the first experiment, which the researchers hypothesized may be due to the use of longer lists or even the subjects hearing the words on a tape recorder rather than in person. For the recognition portion of the study, they found that recognition was better when those words had been previously recalled than in the math condition, which points to the act of recall having a beneficial effect. Additionally, the researchers found that there was a greater sense of recognition among the words marked as the "remember" responses in the recall condition. The "know" responses did not have a significant difference between the recall and math conditions, though the false alarm of words was most often judged as "know" responses. Like in the first experiment, the students recognized the critical words at an almost equal rate to the presented words, though its effect seemed to be much stronger in this experiment. The researchers also found that the recall condition was associated with students falsely "remembering" words on the list. This was true for both the math and recall conditions, though it occurred more for the latter condition.

Overall, the study showed the powerful effects of false memory, as the researchers found very high levels of both false recall and false recognition in both studies. The students seemed to consciously remember the falsely recognized words. The study also revealed that prior recall could increase memories, both accurate and false, often accompanying "remember" responses.

The authors think that these false memories may be due to an activation of implicit associative responses. The intrusions could originate during the encoding of the lists, consciously during the studying, or traditionally implicit in the sense that the subject may have never been aware of the word associations. The authors believe that their study produced high levels of false recognition due to the fact that all of the words on each list were related to each other in some way. The researchers also proposed that if these false memories are because of associative processes, then they could be predicted by formal models of associate processing. While the formation of implicit associative responses may be the cause, the researchers are in no way certain and still look to other hypotheses for explanations. The authors propose that while these false memories begin to take form at encoding, storage and retrieval processes may also play a role, citing the placement of critical words near the end of the recognition tests and the fact that students often recalled the critical word near the end of their recalled list of words.

In their discussion, the authors note that engaging in recall prior to completing a recognition test increased the recognition and "remembering" of both the presented words and the critical words. They believe that generating a word during the recall test strengthens the student's idea that it is correctly identified and therefore increases the chance of recognition later in the study. The authors believe two source monitoring errors could be the cause of these false memories: they remember recalling the word in place of remembering the actual studying the word or they just remember thinking of the item during the study period instead of remembering hearing it. Despite this, the authors find the attributional analysis of memory, in which the students would have misattributed their current cognitive experience to a concrete past event that did not actually occur, as the most apt explanation for the studied phenomenological experience.

In 1976, researchers argued that semantic processing must be paired alongside organization for a proper recall of words (Bellezza, Richards, and Geiselman, 1976). In their study, they sought to demonstrate that organization is not just a result of semantic processing and can be manipulated by itself. They ran three experiments, with each one building off the one prior.

In their first experiment, 56 participants were individually tested and randomly assigned to one of two conditions. One condition instructed participants to construct sentences to simply remember the word on a subsequent recall test, while those in the story condition were told to make their sentences flow into one single story. There were four randomized word lists, each composed of 42 nouns. They saw each word for 11 seconds, during which time they were asked to meaningfully include the word in a sentence and then rate the difficulty of using the word on a five-point scale. After going through their list, each participant was given four minutes to write down as many words as they could remember.

The second experiment was performed with 24 undergraduate students. The participants were randomly assigned to study one of four word lists that each comprised 40 nouns. To examine the remember vs. story condition, two of the lists had every odd-numbered word preceded by an 'X' and every even-numbered word preceded by an 'O.' The other two lists were switched, with every odd-numbered word preceded by an 'O' and every even with an 'X.' Each word was shown for 15 seconds. Each student then had to meaningfully use the word in a sentence and then rate the difficulty of including the word in the sentence. After the participants were presented with the entire list, they were given a one-minute distractor test, in which they were instructed to write down 12 new words not presented on the lists that started with the letter 'a.' Then, they were given one minute to write down as many of the 'remember' words as

possible, followed by a minute of writing down as many ‘story’ words as possible. The participants were then given a recognition test. They were presented with 20 X words and 20 distractors that were all randomly ordered. Next to each word, the student was instructed to mark whether or not the word had originally appeared on the previously studied word list along with the confidence level of their response, which was rated on a three-point scale. After this first recognition test, the students were given the same test except now with the ‘O’ words. The researchers made sure that the ‘story’ words were tested first half the time and that the ‘remember’ words were tested first the other half of the time. In addition, the participants were told that the test was made up of words both originally presented and absent from the list.

Experiment three was conducted to examine the retention effect of semantic processing and organization, but now testing recall and recognition 24 hours after the original presentation of the words. The researchers used the same methods as the first experiment with the exception of the timing of the recall and recognition test. Here, the 32 participants were dismissed following the presentation of either the ‘story’ or ‘remember’ words, with instructions to not think about the lists. The participants returned for a second session 24 hours later to complete the memory portion of the study.

In analyzing the recall data from the first experiment, the researchers found a recency effect was present in both conditions. However, they also found that the students in the story condition produced a higher average recall rate compared to the students in the remember condition. In relation to the difficulty ratings, the only significant finding was that the story condition gave the words an overall higher rating of difficulty than those in the remember condition. When correlating recall with difficulty, the higher level of difficulty of the semantic task was linked to better recall. To test if this result was a byproduct of the story condition being

more difficult overall, they conducted a point-biserial correlation between the difficulty of each word and whether it was recalled for each subject. They found that there was not a statistically significant effect. This corroborates earlier evidence cited by Hyde (1973). In addition, the researchers hypothesized that in the story condition, because participants were creating a story using the words in the order presented, the order of recall would positively correlate with the order of presentation. However, they found no significant difference in the order of recall between the two conditions, with a pronounced recency effect for both.

In the second experiment, in a variance analysis between the learning condition and serial position, they found that both the learning condition and serial position had a significant effect on recall. Regarding the learning condition, the 'story' words resulted in a higher mean number of words recalled. The significant difference showed both a primacy and recency effect. Additionally, the participants also rated 'story' words as more difficult than 'remember' words to include in the sentences they created. However, upon further analysis, there were no significant effects when correlating recall with difficulty. To examine the effects of sequential organization, words were ranked in correspondence with the order of the presentation and order of recall. Using a rank correlation coefficient, they found no significant difference between the two conditions, though the overall mean correlation had a significant result of being greater than zero. Finally, in both conditions, the participants recognized the word lists almost perfectly, meaning that the organization instructions that the participants heard did not have a significant effect on their performance.

The recall results of the third experiment indicated no significant interaction between the learning condition and serial position. However, independently, the learning condition had a significant difference, with a higher mean number of recalled words for the story group. Once

again, the story words were rated as more difficult than the remember words to include in sentences, though there was not a significant correlation between recall and difficulty for both the story and remember groups. Additionally, there was no significant effect on the sequential organization of the words. In analyzing the recognition data, the researchers found that the mean probability of recognition was the same for both groups and found that there was no significant difference in participants' recognition performance.

The results of the first experiment indicate that intent has no effect on learning except for signaling that the subject should meaningfully process the information. This was evidenced by the fact the story condition did not have higher recall rates. Processing using the story mnemonic demanded more effort from the participants than the remember condition, which, in turn, did not aid them in the recall task. Additionally, the negative correlation in the first experiment between the order of presentation and recall provides evidence that organization is not sequential, though they concede that it could be due to the experiment's procedure.

The second experiment resulted in similar results as the first, in that 'story' words were recalled better than 'remember' words. This was true despite the fact that the availability of the words was the same for both groups. The authors believe this may be due to the organization techniques making the 'story' words more available to the participants. They reason that the difficulty of the story mnemonic may explain why it is not used more naturally in real-world situations. They further argue that the difficulty is not related to the depth of processing, as the recall rate would have been higher for words rated more difficult.

The findings of the third experiment are consistent with the first two experiments, as the story words had a superior recall rate even after the 24 hours had passed. However, it is also important to note that only approximately 60% of the words were recalled the next day compared

to immediate recall in the second experiment, which shows there is a difference in recall. The authors purport that the higher difficulty ratings of the story words may be due to the difficulty in forming a sentence relating to a coherent story than a stand-alone sentence, as required by the remember condition. The third experiment further aligns with the second experiment when analyzing the sequential organization. Both experiments show that the type of organization affected recall but not recognition. Furthermore, the fact recognition remained high after 24 hours shows that the words in both sets were processed extensively.

Overall, all three experiments supported the idea that both semantic processing and organizational activity are required for optimal recall. Because the difficulty ratings of the story words were consistent across all experiments but were not recalled at a higher rate, the researchers argue that the difficulty may have arisen from the task's difficulty of creating an organizational structure, rather than deep processing. The sequential organization data does not support this same hypothesis, though they argue it may be due to the loose central themes of the stories, which had little sequential structure. Moreover, the benefits of the organization of words using story mnemonics rely on the comprehension of the words first. The researchers argue that one is better able to remember new information if it can be related to a familiar, or previously stored, memory.

In a more recent study, Nairne, Pandeirada, and Thompson (2008) wanted to examine further the comparative strength of memory retention between survival-based processing and other deep-processing prompts. Although this relationship has been previously researched, the authors wanted to compare proven and successful methods of deep processing with a survival component. They argue that, without knowing the reasoning as to why our memory evolved to its current state, it is difficult to understand the memory system as a whole.

The authors conducted incidental learning experiments to examine these relationships. Using a between-subjects design, they randomly assigned 300 university subjects to different conditions. Some students received one of the following four prompts: a survival scenario, pleasantness, ease of generating a visual image, or ease of generating an autobiographical memory. They were instructed to rate a set of 30 words regarding their relevance to their given condition. In another condition, subjects had to unscramble letters of the word before rating for pleasantness. In the last condition, subjects were directly told to remember the words for a retention test later. Subjects were individually shown the words one at a time and asked to quickly rate them according to their given condition on a one-to-five scale. Then, they completed a digit recall task. After the digit span task, participants had 10 minutes to recall the words from the previously studied lists.

The primary results indicated that the survival condition stood out with the best retention compared to the other conditions, among which there was little differentiation. It was also noted that the response times among the survival conditions were much slower than the other groups, though that is not thought to have much of an impact on the results.

The authors also conducted a second, follow-up experiment to rule out the possibility that the higher retention levels in the survival condition were due to a thematic explanation rather than an evolutionary one. 24 students were given 38 new unrelated words that were divided into blocks of eight. The subjects were randomly split into two groups. Each group rated 16 words under a thematic survival condition and 16 words under a thematic vacation condition using the same procedures as the prior experiment. Once again, the survival condition showed a much higher level of retention compared to the vacation condition, with no notable differences in response times.

The authors believe that these results are a strong indication of the power of survival-oriented processing. Because the survival condition was being compared to other well-known deep-processing techniques, they argue that their results provide evidence of the strength of survival processing. Additionally, the authors believe that this survival processing is a result of the human bias to ensure fitness and the species' survival. Finally, the authors acknowledge that this study is based on the idea that memory is most likely functional in nature.

Otgaar and Smeets (2010) set up two experiments to explore the effects of survival processing on adults' vulnerability to false memories. They also wanted to determine whether the supposed advantage of survival processing generalizes to children. Otgaar and Smeets reflected on prior experiments in which the survival processing condition produced high levels of false memories in conjunction with high levels of correct recollection. They suggest that this may be evidence that survival processing may in fact be a causal factor in the production of false memories, and therefore wanted to explore the topic further. Additionally, the researchers ran a third experiment to examine if the type of lists used during the study had any effect on false memories.

In the first experiment, 69 undergraduate students participated in a between-subjects design. The students were randomly assigned to one of the three conditions: survival, moving, and pleasantness. They were then presented with a list of ten semantically related words. In total, the participants were shown six 10-item lists. These DRM lists were composed of words selected from the Dutch word association norms that all connected to a single, nonpresented critical word. All the lists were shown in a random order that remained the same for each list and each participant. The students were then told to rate the words in regard to relevance to their given scenario on a 7-point scale. They had 5 seconds to rate each word. Then, the students

engaged in a two-minute distractor task, the game Tetris, after which they had a surprise free recall test. The students were allotted ten minutes to complete the test, which asked them write down as many words as they could remember.

The second experiment's participants were split into two groups of children, 8-year-olds and 11-year-olds. The study was performed in a similar manner to the first experiment. All children were randomly assigned to a condition and given the same instructions as the adults. The words appeared for six seconds, rather than five, and were presented in the same order as in the first experiment. They rated each word with respect to their given condition on a 7-point scale and then played Tetris for two minutes. Following the distractor test, the children were given a written recall test, which lasted ten minutes.

The third experiment was conducted to consider the effects of the lists used, specifically if the survival condition's intrusion rate would increase when processing categorized lists. The participants consisted of 39 undergraduate students, who were randomly assigned to either the survival or pleasantness condition. Otmaar and Smeets (2010) performed the exact same procedure here as in Experiment 1. All students were tested in individual rooms. There were six categorized lists of 10 words, all related to a nonpresented word.

The results of the first experiment showed a significant effect of the survival group performing much better than the other conditions in terms of remembering presented words. The data also reported a significant effect of condition on false recall, with the survival group producing a higher rate of false memories than the other groups. Between the moving and pleasantness conditions, there were no significant differences. Otmaar and Smeets (2010) also examined if the rating data had any effect. They found that while there was a significant effect for the pleasantness condition, there was no influence on the survival condition and that the

ratings did not affect the false recall rates. In regard to the pleasantness condition, the students in this condition provided higher ratings than the students in the survival condition, but no other differences were statistically significant. Examining net accuracy, which compared adults' adaptive memories to other memories, the researchers found no significant effects of condition.

In regard to true recall, the second experiment yielded a significant Age x Condition interaction, showing that both groups in the survival conditions had a higher recollection of the words than the other two conditions. Additionally, there were differences in the older children, in that those in the moving condition remembered more words than those in the pleasantness condition. The data also showed a significant effect of condition on false recall. For both age groups, levels of false memories were significantly higher in the survival condition than in the other conditions. The researchers also found that the older group was more likely to falsely recall words on the lists than the younger groups of participants. The intrusion rate for the 11-year-olds was higher in the survival condition than in the moving and pleasantness conditions. The rating data revealed that, for both age groups, the pleasantness condition yielded higher ratings compared to the survival condition, but that this effect did not have an effect on the recall data. Finally, the researchers looked at net accuracy, which had a significant effect of age, in which the younger children earned higher net accuracy levels than the older children, but no effect of condition.

In the third experiment, Otmaar and Smeets (2010) found that there was a significant effect on true recall, as the survival group outperformed the pleasantness group. For false recall, they found that the survival condition yielded more false memories but found that this was not significant when looking at the total intrusions. Once again, higher ratings were reported from the pleasantness group, but this data did not affect the false recall rates. Additionally, they found

that there was a survival recall effect when the recall data was included as a covariate. The pleasantness group also had a significant advantage when examining the net accuracy data.

Otmaar and Smeets (2010) found that the results of the third experiment complement the findings of the first two experiments, as it showed even with categorized lists, the survival condition results in high true recall at the expense of increased levels of false memories. They also note that this study provides evidence in favor of the idea that adaptive memory benefits begin in childhood, which in turn, suggests that survival processing is a robust phenomenon that can be generalized across age groups.

When comparing the first two experiments, the researchers found that all of the groups in the survival condition remembered more words than participants in other conditions. However, false memory rates were also higher in the survival condition compared to the other conditions. The authors note that when reviewing the net accuracy levels, they found no survival recall advantage. Therefore, the authors argue that, because this advantage is lost when examining the net accuracy data, their findings may be grounds to reject the idea that survival processing is an adaptive memory strategy. However, they also acknowledge that the false memories could be a side-effect of another adaptive process engaged in processing and memory.

Because the survival condition lead to an increase in both true and false recall, Otmaar and Smeets (2010) believe that it could be explained with the fuzzy-trace theory (FTT), which would mean those subject to the survival condition would be using gist processing. FTT predicts that the true and false memory rates will increase with any manipulation also increasing participants' reliance on the 'gist' of a previously studied set of information.

The above studies indicate that false memories can be easily implanted by presenting participants with lists of words related to critical nonpresented words (Deese, 1959, Roediger &

McDermott, 1995). Further, they have demonstrated that both story processing and survival processing represent methods of increasing the recall performance of participants relative to other well-known deep processing tasks (Bower & Clark, 1969, Nairne et al., 2008). Finally, Otmaar and Smeets (2010) showed that processing lists of words designed to induce false memories using a survival scenario increased both veridical or correct memories in addition to false memories. The purpose of the present study was to determine how processing such lists in a story condition effects both correct and false recall relative to survival processing and a pleasantness processing control condition. In the present experiment, participants studied lists designed to elicit false memories in one of these three conditions. Consistent with prior work (Otmaar & Smeets, 2010) we predicted that story processing, like survival processing, would increase both correct and false memories relative to a pleasantness control condition.

METHODS

Participants.

Ninety undergraduate psychology students attending the University of Mississippi participated in the experiment in return for partial course credit.

Design, and Materials.

A between-subjects design was employed in which participants were randomly assigned to one of three instructional conditions. Thirty participants were asked to create a story using a list of 30 items comprised from 3 separate lists designed to elicit false memories. More specifically, three 10-item lists from were selected from Stadler and Roediger's (1999) norms for word lists that have been demonstrated to be effective in eliciting a nonpresented 'critical' item (see Appendix). In addition, 30 participants listed survival related attributes for each of the same words whereas another 30 participants listed pleasant or unpleasant attributes for each word on the 30-item list.

Procedure.

Participants arrived at the laboratory in small groups ranging from one to three people and were seated in separate cubicles. Other than the participants, the experimenter was the only other person in the room. After signing an informed consent form, the participants were handed a participant response sheet and listened to the experimenter read a set of instructions printed at the top of the form. In all three conditions, the instructions for completing the task were printed at the top of one side of a sheet of paper with the 30-item list printed in a column on the left side of the page underneath the instructions. Participants were told that, during the experiment, they were to use the words printed beneath the instructions to complete the encoding task to which they had been assigned.

In the survival condition, instructions similar to those employed by Nairne et al. (2008) were displayed at the top of the page. Participants were asked to read the instructions silently to themselves as the experimenter read them aloud. The instructions read as follows, "In this task, we would like you to imagine that you are stranded in the grasslands of a foreign land without any basic survival materials. Over the next few months, you'll need to find steady supplies of food and water and protect yourself from predators, (Nairne et al., 2008, p 177). For each of the words listed below, please describe how the word might help you survive in this situation."

Participants in the pleasantness condition proceeded in a similar manner, with the exception that they were asked to list pleasant or unpleasant attributes to the right of each of the 30 words printed in a column on the left side of the page. More specifically, those instructions read, "In this task, we are going to show you a list of words, and we would like you to list several pleasant or unpleasant attributes of each word in the space below." Finally, in the story processing condition, participants were asked to read the following instructions to themselves as the experimenter read them aloud, "Many people find stories to be interesting and entertaining. Please write a short story in the space provided below and be sure to use each of the listed words in your story."

Participants were provided with 10 minutes to complete the encoding task to which they had been assigned. If a participant indicated that they were finished prior to the end of the 10-minute encoding period, the experimenter encouraged them to continue working on the task until the time allotted for the encoding period had expired. Following the encoding phase of the experiment, participants were asked to flip the participant response sheet over. The top half of the back side of the response sheet included 25 triple-digit addition and subtraction problems (e.g., 501 + 803). Participants were asked to complete as many of these problems as they could

during a 60 second distractor period. The bottom half of the back side of each participant response sheet was blank. After completing as many addition and subtraction problems as they could in the time allotted, participants were asked to write down as many list items as they could remember in the blank space underneath the math problems. This free recall task lasted for 5 minutes, and if a participant indicated that they were no longer capable of remembering any more items, the experimenter asked them to continue working on the task until the time was up. After the free recall task, all the participants were debriefed and thanked for their participation.

RESULTS

One dependent variable of interest was the proportion of presented words that participants recalled as a function of the instructional condition to which they had been assigned. These values are displayed in Figure 1. A One-Way Analysis of Variance revealed statistically significant differences in recall scores as a function of instructional condition, F (2, 87) = 5.07, MSe = 0.01, $p < .01$, $\eta_p^2 = .10$. Planned comparisons indicated that participants recalled more words in the story processing condition (M = .76) than in survival condition (M = .71), t (58) = 1.99, $p < .05$. In addition, participants recalled more words in the story condition than in the pleasantness condition (M = .67), t (58) = 3.08, $p < .001$. However, the difference between the number of words that participants remembered in the pleasantness condition and the survival condition was not statistically significant, t (58) = 1.33, p = .18., thereby failing to observe the oft replicated survival processing advantage. Overall, participants in the story processing condition had the highest levels of recall whereas recall performance in the survival and pleasantness conditions was statistically equivalent.

Another dependent variable of interest was the proportion of 'critical' intrusions that participants produced during the recall phase of the experiment. These values are displayed in Figure 2. A One-Way Analysis of Variance revealed no statistically significant differences in recall scores as a function of instructional condition, F (2, 87) = 0.89, MSe = 0.05, p = .41, η_p^2 = .02. Thus, contrary to our hypotheses, participants recalled a statistically equivalent number of critical items across all three instructional conditions.

Finally, we examined the number of intrusions, or unstudied words other than the critical words, that participants wrote down during the free recall stage of the experiment. Intrusions were infrequent (M = .13) across all three instructional conditions. However, a One-Way

Analysis of Variance indicated that there were statistically significant differences observed in the number of intrusions as a function of instructional condition, F (2, 87) = 3.27, MSe = 0.13, p < .05, η_{p^2} = .07. Planned comparisons indicated that participants recalled more nonpresented words that were not critical words in the story processing condition (M = .23) than in survival condition (M = .00), t (58) = 2.54, p < .05. However, participants recalled a statistically equivalent number of such words in the story condition and in the pleasantness condition (M = .17), t (58) = 0.58, p = .57. Finally, the difference between the number of nonpresented words that participants remembered in the pleasantness condition and the survival condition was statistically significant, t (58) = 2.41, p < .05 Overall, participants in the story processing condition and the pleasantness condition had the highest levels of recall for nonpresented words that were not critical words whereas, interestingly, recall performance for those words in the survival condition produced no intrusions at all.

DISCUSSION

Regarding the number of words remembered, our data did align with our prediction nor prior work on the survival processing advantage. Here, participants correctly recalled more words in the narrative story condition compared to both the pleasantness and survival condition. We did not predict this outcome given that previous work (e.g. Nairne et al., 2008) has consistently demonstrated better memory in survival processing conditions relative to pleasantness processing conditions. One reason that the narrative story condition may have led to better recall performance than the other conditions is the positive effect that thematic organization can have on retention (Bower & Clark, 1969). With that, some studies have shown that organization is beneficial only after a participant first comprehends the word or relates it to a previous memory (Bellezza, Richards, and Geiselman, 1976).

In regard to the 'critical' nonpresented item recall rate, there was no significant difference in the false memory rate as a function of the instructional condition to which participants had been randomly assigned. This contradicted our hypothesis that there would fewer false memories in the pleasantness condition than in the other two conditions. This result also differed from past studies (Otgaar & Smeets, 2010) that showed that processing words in the survival condition increased the rate of false memories relative to other control conditions.

The survival condition did, however, have an advantage when considering the noncritical but nonpresented words, or "intrusions." Because the story processing task resulted in not only a decreased rate of these intrusions, but in zero of the noncritical intrusions, it can be argued the survival processing task improves overall recall accuracy. Clearly then, the survival condition led to better overall accuracy than either the pleasantness condition or the story condition. Additionally, we did not observe a statistically significant difference in the intrusion rate

between the story condition and the pleasantness condition. Thus, the survival condition seemed to provide participants with a unique ability to 'filter out' nonpresented words and may be attributed to the functional processing enhancements that survival processing provides (Nairne, et al., 2008).

Overall, the results of the current study were not consistent with our predictions and failed to replicate the results of other similar studies. It is possible that the number of participants in the present study did not provide us with sufficient power to observe differences between the condition (i.e. a Type II error). Future research could involve a greater number of participants. Regardless of the explanation for the observed results, they offer the first attempt to determine how survival processing and story processing differentially influence veridical and false memory rates and open the door for future research on this topic.

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APPENDIX

Critical Lures and Word List

Sweet	**Doctor**	**Chair**
Taste	Nurse	Table
Candy	Lawyer	Legs
Sugar	Medicine	Seat
Tooth	Hospital	Couch
Honey	Dentist	Desk
Sofa	Physician	Recliner
Chocolate	Stethoscope	Sofa
Heart	Surgeon	Wood
Cake	Clinic	Cushion
Pie	Cure	Stool

TABLES AND FIGURES

Figure A – Proportion of Words Correctly Recalled

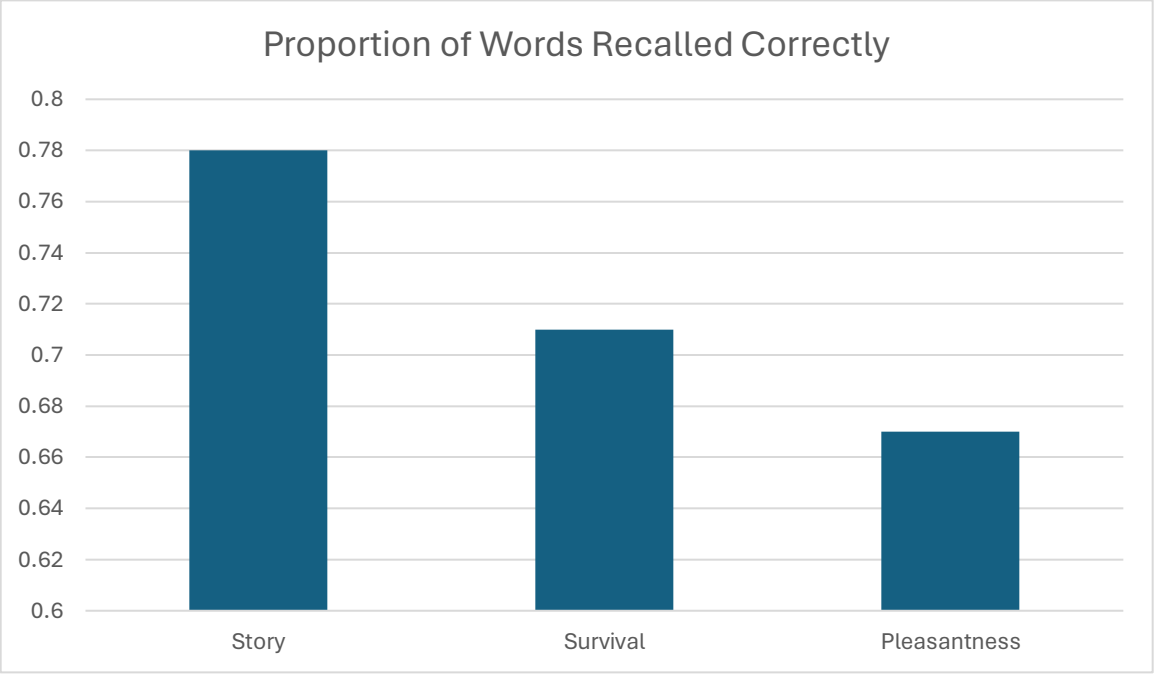

Figure B – Intrusion Occurrences

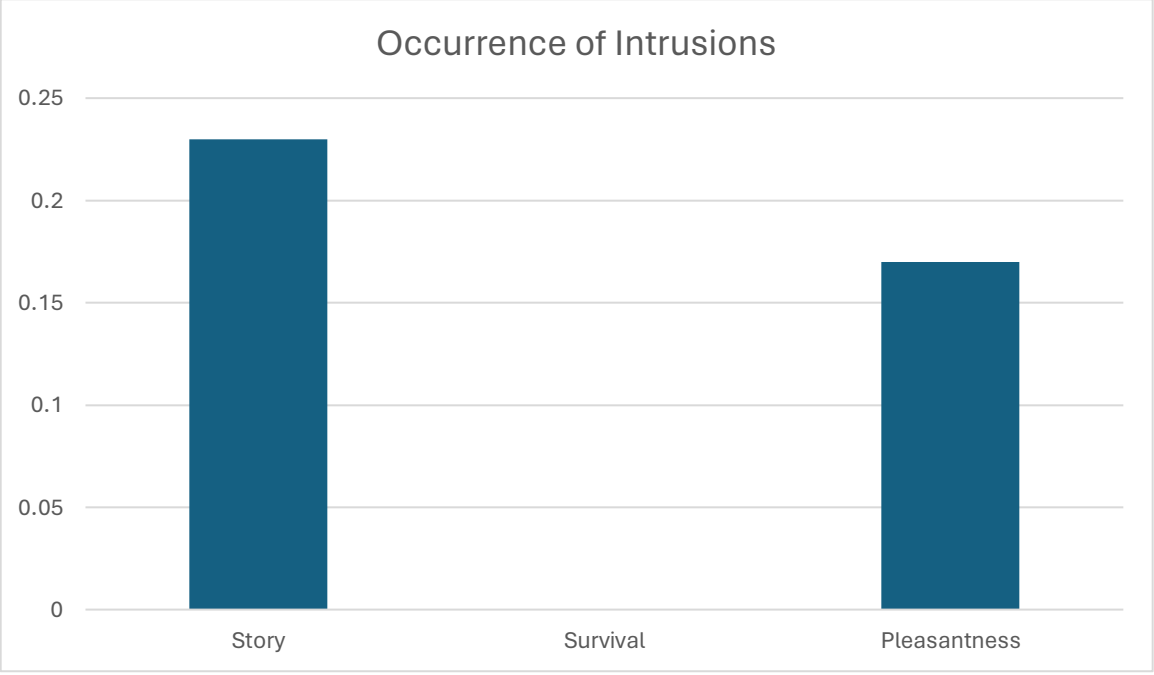

Figure C – Rate of Critical Word Recall