Spring 5-9-2020

The Effect of Story Processing on Memory Performance

Anna Miller
University of Mississippi

THE EFFECT OF STORY PROCESSING ON MEMORY PERFORMANCE

by

Anna Nicole Miller

A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the requirements of the Sally McDonnell Barksdale Honors College.

Oxford

May 2020

Approved by

_____

Advisor: Professor Matthew Reysen

_____

Reader: Professor Stephanie Miller

_____

Reader: Professor Rebekah Smith

_____

ABSTRACT

ANNA NICOLE MILLER: The Effect of Story Processing on Recall Performance

(Under the direction of Matthew Reysen)

The purpose of the present study was to determine how recall performance following story processing compared to both survival processing and pleasantness processing. Participants were provided with a set of instructions depending on the condition they were in, narrative, survival, or pleasantness. Following this, participants rated the words one at a time, completed a brief distractor task, and then attempted to remember as many items as they could. The primary results demonstrated that narrative processing may provide a recall advantage similar to survival processing. These results suggest that similar underlying mechanisms may enhance recall in both sets of instructional conditions.

TABLE OF CONTENTS

LIST OF FIGURES

LITERATURE REVIEW

In 1972, Craik and Lockhart sought to determine the effect that deeper or more meaningful processing has on the likelihood that a person would remember previously presented information. Craik and Lockhart (1972) defined depth as the meaning obtained from a stimulus as opposed to the number of times the stimulus has been previously presented. The theory focuses on the encoding processes that are employed during an experimental task. Although depth can be considered along a continuum, tasks can generally be defined as either "deep" or "shallow." Shallow processing leads to poorer retention of the information as the processing involved in encoding the information is based more on surface characteristics as opposed to the meaning of the information. Shallow processing can be encouraged through structural and phonemic processing tasks that de-emphasize the semantic characteristics of a stimulus. Structural processing involves only taking into consideration the physical aspects of a stimulus, such as the size, font type, or color of a printed word. Phonemic processing involves focusing on sound-based tasks like determining whether or not one word rhymes with another. On the other hand, deep processing involves a focus on the meaning of the information being presented at encoding. Semantic processing tasks include determining whether or not a word fits into a sentence, rating a word for its perceived pleasantness, or forming a mental image of the word.

Recently, Nairne and colleagues (e.g., Nairne, Pandeirada, & Thompson, 2008) have proposed a new semantic processing task based on a functionalist interpretation of the evolution of the human memory system. In a typical survival processing task, participants are asked to envision themselves attempting to survive in the ancestral past. They are then asked to rate the extent to which a list of common nouns would be effective at aiding them in the survival

situation. The ultimate explanation for the apparent benefits of survival processing relative to other deep processing tasks is that the human memory system evolved to aid survival. There is, however, some recent evidence that a narrative task might provide similar mnemonic benefits. The purpose of the present experiment was to determine whether this newly popular narrative processing task could improve recall performance in a similar manner to survival processing when the to-be-remembered items were presented sequentially for a brief duration rather than simultaneously. We will elaborate on the story processing effect below, but first will discuss what has been uncovered to date about the survival processing effect.

In one study, Nairne, Pandeirada, and Thompson (2008), conducted two experiments to compare survival processing with a number of other deep processing tasks. In the first experiment, participants listened to one of six sets of instructions. The experiment consisted of six different conditions. In the survival condition participants were asked to imagine themselves in a situation that would require them to survive on their own. Then they were presented with a list of words and were asked to rank how relevant each of the words were to their survival in the situation. In another condition, participants rated the words for pleasantness. The third condition required that participants rate how easy or difficult the words were to create a mental image. In the fourth condition, participants rated how easily they could personally relate the words on the list to themselves. The fifth condition was a generational condition. It required the participants to switch the first two letters of every word they were presented and then to rate the words on how pleasant they were. The sixth and final condition was an intentional learning condition in which participants knew ahead of receiving the list that they would be given a test on recall afterwards. After listening to the instructions, the participants rated the 30 words. Upon completion of rating, the participants were required to partake in a distractor task and were then given a recall test.

The results of the study showed that the survival condition led to statistically better recall performance than the other five conditions (Nairne, Pandeirada, and Thompson, 2008). Between the other five conditions (pleasantness, imagery, self-reference, generation, and intentional learning) there were no significant differences found in this experiment. The suggestion that the content of the survival condition may have led to the gap in response time as well as the amount of words recalled, led the researchers to conduct a second experiment.

After obtaining these results, Nairne, Pandeirada, and Thompson (2008), decided to conduct another experiment to determine whether the observed differences in recall performance resulted from the lack of thematic content in the 5 non-survival related conditions. To examine this, they had participants rate common nouns with respect to how the words pertained to survival and to rate how the words pertained to their enjoyment of a luxury vacation. The results from the second experiment demonstrated that participants in the survival condition produced a significant difference in recall advantage over the vacation condition, thus, the differences in recall performance observed in Experiment 1, did not appear to result from the lack of thematic content in those conditions.

In a related study, conducted by Yana Weinstein, Julie M. Bugg, and Henry L. Roediger III, set out to determine whether an experiment previously performed by Nairne, Thompson, and Pandeirada (2008) was replicable and if the results from their experiment could be generalized with a different set of words. Weinstein, Bugg, and Roediger set out to discover whether encoding something by relating it to survival was more beneficial than the moving task and pleasantness task. By conducting their experiment, they also wanted to further confirm the theory that survival encoding may lead to more enhanced recall than other deep processing conditions (Weinstein, Bugg, and Roediger, 2008).

In the first experiment, thirty-six total words were presented to the participants; the master list was split into three different lists of twelve based on the encoding condition. To ensure that there was counterbalance, the experimenters randomized the order of the lists, the order of the condition, and the assignment of the word lists to the condition; this created thirty-six different scenarios with two participants in each scenario. The three different conditions were survival, moving, and pleasantness. In regard to the first scenario, participants were asked to relate how the words would help them in survival from a predator in a grassland environment. The moving condition asked for participants to think about how the list of words could pertain to them moving to a new place in a different country. The third condition in this experiment asked for participants to rate the pleasantness of the words presented to them. Participants in each condition were asked to make their decision within a certain time constraint. Once all three scenarios had been completed and the words were rated, participants were given a filler task for two minutes. After this task they then were given a surprise recall test on the words for each condition.

Weinstein, Bugg, and Roediger (2008) found from experiment one that the survival condition presented significantly higher rates of recall than the other two conditions. Their findings also demonstrated that the conditions had a significant effect on response time, being that the pleasantness condition produced far shorter reaction times than the moving and survival condition. The conclusion that can be drawn from experiment one is that the study conducted by Nairne, Thompson, and Pandeirada can in fact be replicated and even extended, and that survival had a significantly better advantage in recall than pleasantness and moving.

The second experiment in this article sought to determine whether self-relevance of a word leads to better memory (Weinstein, Bugg, and Roediger, 2008). A second goal of the

second experiment was to determine whether the survival condition is better suited towards our ancestral experiences or those that we might find ourselves in today. The second experiment manipulated both the perspective and the context in the conditions. This resulted in six different situations for participants: grassland survival first person, grassland survival third person, city survival first person, city survival third person, moving first person, and moving third person. The moving situation was used as a control to determine yet again whether survival in general was more beneficial. The participants all rated the words in the same order and performed the tasks twice, but the order of the situations was randomized to counterbalance the experiment. Once participants completed the tasks, they were given a filler task, a demographic questionnaire, and a questionnaire about their television viewing habits; then they were given the recall test.

The results from experiment two demonstrated that the grassland condition produced the highest recall followed by the city condition, and then the moving condition. This solidified the idea that survival is more beneficial to encoding important information. The study showed that the difference between those that scored higher on the moving scenario than the survival scenario was significant. In the participants that reported never watching survival shows, there was a significant advantage for their survival recall. Recall for the grassland scenario was higher than the recall for the city survival scenario. Participants in the grassland scenario actually achieved higher recall when they were presented with the third-person instructions than those presented with the first-person instructions; the opposite is true for the city survival condition. The second experiment concludes that the findings of Nairne, Thompson, and Pandeirada (2008) are consistent even when the conditions are almost identical in processing; they also found that the

evolutionary hypothesis about ancestral experiences triggering stronger memory recall was consistent with their results (Weinstein, Bugg, and Roediger, 2008).

In another related study Kang, McDermott, and Cohen (2008) sought to determine whether the findings of a previous study by Nairne et al (2007) could be replicated. Kang et al decided to replicate the study using a different control condition than the one used in Nairne et al's study. The experiments were also all aimed at further solidifying the belief that memory is developed and designed to benefit survival.

Experiment one's goal was to determine if a condition that was more similar to survival than the one previously used could produce similar results in recall as the survival condition (Kang, McDermott, & Cohen 2008). The first experiment used three different conditions; they were survival, burglary, and pleasantness. Each subject was presented with a list of sixteen words for each of the three scenarios. The words in each list were presented to the students in a randomized order; however, the conditions were presented to the participants in a set order. While stationed at a computer, students were presented with the list of words and asked to rate the words based on which condition they were in. The survival condition asked students to rate how relevant the words would be to helping them survive in a grassland environment. The burglary condition asked participants to rate how relevant the words would be in helping them successfully rob a bank. The pleasantness condition asked students to rate how pleasant they thought the words in the list were. After completing all three conditions, participants were asked to participate in a distractor task and then were surprised with a timed recall test.

The results of this study showed that rating words on how relevant they were for survival produced better recall than both the burglary and pleasantness condition (Kang, McDermott, & Cohen 2008). In fact, the recall for the survival condition proved to be significantly more

beneficial than the other two conditions. The researchers concluded that relating words to survival leads to better memory recall. Kang et al felt it was necessary to conduct another experiment in which they further test this idea.

The second experiment sought to discover whether the higher recall for survival could be extended towards recognition memory as well (Kang, McDermott, & Cohen 2008). Unlike experiment one, experiment two used 128 different words split up into four sets. Participants rated thirty-two words in how they pertained to survival and burglary. The word sets were presented in a random order. The recall test for experiment two involved all 128 words being presented to the student and then they were asked to determine if the word was "new" meaning not rated or "old" meaning already rated. The results showed that recognition for the survival condition was higher than that of the burglary condition.

Experiment three sought to determine whether the benefits of survival memory can only be expected to be higher when it is related to the self, and because of this extension determine how far the survival condition can be manipulated. Experiment three used clips from movies instead of paragraphs to read. There were forty-two words used for experiment three split up into three different lists. In the survival condition, participants watched a ninety second clip from *Cast Away* and were asked to determine whether the words in the list would help lead to his survival on the island. In the burglary condition participants watched a ninety second clip from *Inside Man* and were asked to rate the words on how they would help the character in his bank robbery operation. The third experiment also used a pleasantness condition. After completing all three conditions, the participants were given a distractor test and then a recall test. After the recall test, all participants were asked if they had ever previously seen either movie. The results from experiment three mirrored those found in the first two experiments. Recall for the survival

condition was once again significantly higher than the other two. Kang, McDermott, and Cohen (2008) found no advantage in whether participants had previously seen the two movies or not.

Another related study focuses on trying to determine whether human memory has evolved to benefit our past. Otgaar, Smeets, and van Bergen (2010) conducted two different experiments comparing survival memory to other deep processing tasks by using pictures instead of words. The overall goal of their first study was to determine if survival processing could be done using pictures, and also whether it would affect a correct recall of details.

To decide which pictures to use, Otgaar, Smeets, and van Bergen (2010) selected thirty pictures that were similar to the list of words used in a previous study on a similar subject. They then divided these words into their arousal levels such as low versus high-arousal and low versus high-pleasure pictures. The first experiment employed three different conditions: survival, moving, and pleasantness. They measured five different dependent variables: rating of pictures, recall, number of words, correct details, and incorrect details. Each participant was randomly assigned to a condition. In the survival condition, they were asked to imagine themselves alone in a savanna, and to determine whether the pictures they were presented would be beneficial to their situation. The moving scenario instructed participants to imagine themselves moving to a foreign land, and to rate how beneficial each image would be to helping them. The third condition focused on pleasantness and asked participants to rate how pleasant they viewed each image. After rating the images, they were given a distractor task and participants were then asked to recall as many of the images as they could that they had seen previously for ten minutes. After this they were then asked to describe the images they viewed and each incorrect or correct detail was scored by the experimenter. Otgaar, Smeets, and van Bergen scored the correct and incorrect

details by giving a correct point for each color, number of items in the picture, or number of people, and giving points for incorrection if they got these criteria wrong.

The results of experiment one displayed that there was a significant difference of recall in the survival condition than the moving and pleasantness condition (Otgaar, Smeets, and van Bergen 2010). A repeated measures ANOVA revealed that high and low arousal images were better remembered in the survival condition. There was a significant difference in the amount of correctly recalled details between conditions as well as a significant difference in the amount of incorrect details. The researchers believed that their results from this experiment gave further evidence supporting the idea that survival leads to better memory recall. They also found that their effect size was larger than those found in previous studies.

In Experiment 2 Otgaar, Smeets, and van Bergen (2010) wanted to determine whether there was a difference in recall for pictures over words. The same thirty images from experiment one were used and were divided into two different groups. There was then a set of words assigned to the pictures which created four different versions of the study: picture set A and word set A, picture set A and word set B, picture set B and word set A, and picture set B and word set B. Participants were randomly assigned to the condition of either survival or moving. After viewing all the words and images and subsequently rating them, participants were asked to participate in a distractor task for two minutes and were then given a surprise recall test for ten minutes. The results for experiment two showed that there was a significant effect on the condition, meaning that recall was higher for the survival condition.

A sixth study aimed to further determine the benefit of narrative processing. Reysen, Reysen, and Joyner (2020) set out to determine what the benefits of storytelling could be when it pertained to memories. The overall goal of the study was to try to determine whether story

processing may have beneficial effects that are similar to those demonstrated in survival processing.

The three different conditions used in the experiment were pleasantness, story / narrative, and survival. The words presented to participants came from a word norms study (Van Overschelde, Rawson & Dunlosky, 2004). Participants entered the laboratory in groups of 1-4 people. In the pleasantness condition, participants were asked to list something pleasant or unpleasant about the words in the list. In the survival condition, students were asked to imagine themselves in a foreign land, and to write how they could use each word to survive. The narrative condition involved the participants writing a short story that included as many words as possible from the list. The words could be included in any particular order, and if they could not figure out how to use a word, they were instructed to write the words at the bottom of the page. Each participant was given a time limit of 10 minutes to complete their task as instructed by the experimenter. Participants were then asked to flip their page over and complete simple multiplication problems. Once the 2 minutes were up, the participants were asked to remember as many words as possible from the list they were given in no particular order. In all three conditions, all twenty words were presented simultaneously and participants had the opportunity to work them in any way they saw fit during the encoding phase of the study.

The results from this study showed that participants remembered more words in the story condition than those in the pleasantness condition. Replicating previous studies (e.g., Nairne et al., 2008) participants also recalled more words in the survival condition than in the pleasantness condition. Perhaps most interestingly, the results also demonstrated that the participants recalled more words in the narrative condition than in the survival condition. The results also found that there was a marginally statistically significant difference in the amount of intrusions produced in

each condition. More specifically, more intrusions were observed in the story and survival conditions than in the pleasantness condition.

The present study was designed to investigate the effects of narrative processing using a paradigm almost identical to those used by Nairne and colleagues. More specifically, rather than implementing a simultaneous processing task and using only 20 words, participants were instead asked to complete a sequential processing task. In addition, rather than have participants list various attributes of the words, they were instead asked to complete a more traditional rating task. The study used undergraduates from the University of Mississippi who were placed in one of three different conditions. The three conditions were a pleasantness task, a survival task, and a story task. In all three conditions, participants were asked to study a list of thirty common nouns. In the pleasantness task the participants were to rate how pleasant they felt the words were. The survival task asked participants to rate how relevant the words they received were to helping them survive in an unfamiliar situation. The narrative task asked them to rate how easily it was to incorporate the word into a story. Upon completion of viewing and rating the words, participants were given a distractor task and then were asked to complete a free recall test.

Method

Participants

The participants for this experiment were undergraduate psychology students from the University of Mississippi. There were 37 total participants. In return for their participation, participants received partial course credit for their introductory psychology classes. All subjects were recruited through the SONA system. The experiment implemented a between subjects design with three different conditions. The three different conditions were pleasantness, story /

narrative, and survival. The pleasantness condition was used as a control condition for this experiment.

Materials and Apparatus

The words presented to participants came from a word norms study (Van Overschelde, Rawson & Dunlosky, 2004). The list of words contained 30 unrelated common nouns. The experiment in its entirety took place in a computer lab in the psychology department building on the campus at the University of Mississippi.

Procedure

The participants entered into the laboratory in small groups of 1 – 4 students. Following this, they provided their consent to participate in the study. The experimenter then read the groups one of three sets of instructions and asked them to read along with them on their copy.

- *Pleasantness.* "In this task, we are going to show you a list of words and we would like you to rate the pleasantness of each word. Some of the words may be pleasant and others may not -- it is up to you to decide. The rating scale will range from 1 (totally unpleasant) to 5 (extremely pleasant). Each word will appear on the screen for several seconds. After considering each word, please type a 1, 2, 3, 4, or 5. The number that you type will appear on the screen beneath the rating scale. Then after a brief delay, the next word will be presented. Please be sure to make your decisions quickly and try to use the entire rating scale."
- *Survival.* "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 will need to find steady supplies of food and water and protect yourself from

predators. We are going to show you a list of words, and we would like you to rate how relevant each of these words would be for you in this survival situation. Some of the words may be relevant and others may not -- it is up to you to decide. The rating scale will range from 1 (totally irrelevant) to 5 (extremely relevant). Each word will appear on the screen for several seconds. After considering each word, please type a 1, 2, 3, 4, or 5. The number that you type will appear on the screen beneath the rating scale. Then after a brief delay, the next word will be presented. Please be sure to make your decisions quickly and try to use the entire rating scale."

- *Narrative / Story*. "Many people find stories to be interesting and entertaining. In this task, we are going to show you a list of words. We would like you to use the words in the list to create a short story. Some of the words may be easy to include in your story whereas others may be more difficult. As you include each word in your story, we would like you to rate how easy or difficult it was to include the word in your story. The rating scale will range from 1 (very difficult) to 5 (extremely easy). Each word will appear on the screen for several seconds. After considering each word, please type a 1, 2, 3, 4, or 5. The number that you type will appear on the screen beneath the rating scale. Then after a brief delay, the next word will be presented. Please be sure to make your decisions quickly and try to use the entire rating scale."

Each participant was given their task while they were at a computer. Participants viewed the words on the screen for five seconds and were then asked to rate the word on a five-point scale as it pertained to the condition they were randomly assigned to. Following the encoding phase of the experiment, each participant completed a brief math distractor task (simple addition and subtraction problems) for 60 seconds. Once the distractor task was completed, the

participants were asked to remember as many words as possible from the list items they had rated earlier. This recall phase of the experiment lasted 5 minutes. If a participant reported, prior to the end of the 5-minute interval, that they could no longer remember any items, the experimenter asked them to keep trying until the time allocated for the recall phase had expired. They were not asked to remember the words in any particular order. After completing the experiment, the participants were thanked and then debriefed. All participants were given their credit for their class upon completion of the experiment and debriefing.

Results

In the present experiment, participants rated 30 words in one of three conditions (story, survival, or pleasantness), then completed a brief distractor task, and then attempted to recall as many words as they could from the list they were given. Although our primary dependent variable of interest was participants' free recall scores, we also recorded intrusions (or the recall of words not on the list), measured the amount of time it took participants to make each rating, in addition to the value (that was on a scale from 1 to 5) that participants rated each word.

First, it was possible that some words on the list we selected may have been more relevant to one of the conditions than the others. It is also possible that, if this possibility occurred, it may have influenced participants' subsequent recall performance. To examine this possibility, we conducted a One-way Analysis of Variance (ANOVA) on participants' ratings as a function of their instructional condition. The result of the ANOVA was not statistically significant, F (2, 34) = 0.62, $p > .05$. This result suggests that the words were equally relevant across all three instructional conditions.

Next, we analyzed participants' pattern of reaction times as a function of their instructional condition. It is possible that participants may have spent more time rating the

words in one condition than another. In other words, although each word appeared on the screen for 5 seconds, participants may have spent more of those 5 seconds considering their value response in one condition than another. If this possibility occurred, the difference in processing time may have influenced participants' subsequent recall performance. To examine this possibility, we conducted a One-way Analysis of Variance on participants' response times as a function of their instructional condition. The result of the ANOVA was not statistically significant, F (2, 34) = 3.07, $p > .05$. This result suggests that participants took relatively equal times to respond to each word despite their assignment to different instructional conditions.

We also counted the number of times that participants remembered a word that was not included in the list of words that they rated at the beginning of the experiment. Although some instructional conditions may lead to better overall recall than others, it is also possible that some conditions may promote an increased level of intrusions. To examine this possibility, we conducted a One-way Analysis of Variance on participants' intrusions as a function of their instructional condition. The result of that test was right at the level of statistical significance, F (2, 34) = 3.27, $p = .05$. Because we observed this result with the relatively low number of participants included in this analysis, we decided to more closely examine this pattern of intrusions with a series of independent samples t-tests. First, participants in the story condition and the survival condition had statistically equivalent numbers of intrusions, t (22) = 0.58, $p > .05$. Participants in the story condition, however, did have more intrusions, on average, than participants in the pleasantness condition, t (22) = 2.11, $p < .05$. In addition, participants in the survival condition had more intrusions, on average, than participants in the pleasantness condition, t (24) = 2.74, $p < .05$.

Overall, participants were more likely to remember words that were not presented on the list in both the story condition and the survival condition than they were in the pleasantness condition. One possibility for this result is that participants may have remembered more words, on average, in those two conditions than in the pleasantness condition. It seems possible that as the number of words recalled increases, the number of intrusions might increase as well. To determine whether we observed this result, we conducted a One-way Analysis of Variance on participants' recall of words included on the list as a function of instructional condition. The result of that test was statistically significant, F (2, 34) = 25.62, $p < .001$. As with the intrusions, we more closely examined this pattern of responses with a series of independent samples t-tests. First, although there was a numerical difference between recall performance in the story condition ($M = .51$) and the survival condition ($M = .44$), this difference was not statistically significant, t (22) = 1.39, $p > .05$. Participants did, however, recall more words in the story condition than in the pleasantness condition ($M = .24$), t (22) = 11.15, $p < .001$. In addition, participants also recalled more words, on average, in the survival condition than in the pleasantness condition, t (24) = 4.88, $p < .001$. Overall, recall performance was better in both the story condition and the survival condition than in the pleasantness condition. In addition, performance was statistically equivalent in both the story and survival conditions.

Discussion

The experiment being discussed was performed to determine if there was a potentially more beneficial way to process information than what has previously been acknowledged as the best processing tactic (survival). Processing by using the survival method has been acknowledged as potentially the best way to process information and store it into our memory. In a previous study, it was observed that story processing may lead to better recall

performance than survival processing. However, the methodology used in that study differed from the standard survival processing paradigm in two important ways. First, all of the items were presented simultaneously rather than sequentially. It is possible that presentation style may have influenced the observed pattern of results. In addition, participants in that study were actually asked to write down attributes related to the words they were processing. In the standard survival processing paradigm, participants are typically asked to rate items for a given attribute rather than list attributes. The present experiment set out to determine if narrative, or story, processing could become the more advantageous way to process data – even when the story processing condition was included in a more traditional survival processing paradigm. The results of this experiment showed that story processing condition provided a similar recall advantage to survival processing condition when compared with a pleasantness processing task.

The studies that were previously described in the literature review section, except one, found that the survival processing condition was the best way to encode words and store them for later recall. In all of the experiments reported above using the standard survival processing paradigm, the survival processing instructions led to better recall results than the other conditions employed. Our results from the experiment aligned with those found in previously performed experiments in that the survival processing condition produced better recall than the pleasantness condition, but our results did have a different outcome than others in that the survival processing condition did not necessarily have better rates of recall overall as the narrative processing condition produced an equal performance statistically with the survival condition.

The results from our experiment could demonstrate that survival processing may not be the best way for humans to encode data as it was once believed. The results could demonstrate that the human brain is more adept in remembering information when it is related to a story.

There is a multitude of evidence supporting the idea that humans have passed down their lineages and history orally for centuries. This evidence could support the idea that the human brain is more apt at remembering information when it pertains to a story or when it is used to create a story. The results from the experiment could indicate that one way to better remember information is to encode it into their memory as a story so as they are more likely to remember the information. Some of the previously mentioned studies in this paper concluded that the superior processing mechanism was survival processing, and this may have occurred because of the belief in the evolutionary benefits that fighting for survival has had in humans. Another interesting finding from the experiment was the statistically significant amount of intrusions that occurred in the survival and narrative processing conditions. Because the amount of intrusions in both of these conditions were statistically higher than those in the pleasantness condition the results could have been skewed, but because both the survival and story condition resulted in statistically equivalent amounts of intrusions the results compared between these two conditions should remain accurate. The intrusion words could have occurred because of many different reasons, one being that when creating a story or thinking of how a word will help you survive many different words relating to the condition a person is in could come to mind and over-shadow the words they are trying to remember. This could have affected both the survival and story condition, which might explain the number of intrusions in these two conditions and the lack of intrusions in the pleasantness condition.

There were some limitations to the experiment performed for this paper. The first being that because the distractor task was simple addition and subtraction problems, the participants may have chosen not to participate in actually trying to solve the problems. If they did not participate in the distractor task, they could have been provided an unintentional advantage over

participants that did freely complete the math problems. To combat this potential limitation the program that the experiment was run through on the computers, could make it necessary for students to complete in order to advance to the recall portion of the experiment. Because a timer of one minute was used, it could have been very easy for participants to sit at the computer for the sixty required seconds without actively completing the distractor task, and by designing the experiment to require responses during this one minute different results might have been observed. A second and possibly more evident limitation of this experiment is the lack of participants. This was due to the worldwide pandemic of COVID-19. Because the University of Mississippi deemed it necessary to change all classes to online learning and to close the residence halls on campus, there was a lack of students around to participate and collect data for this experiment. If the school had not determined that such steps were necessary for the safety of the students and the staff, the results may have been different. To determine if participant size has an effect on the results of the experiment, the study could simply be repeated at another time with a larger number of participants.

Every human around the world at some point in their day, week, and life are required to remember information. Whether this information is something as simple as their groceries for the week or something as complex as how to perform a twelve-hour lifesaving reconstructive heart transplant surgery, every person needs to remember information. Through this experiment and the discussion that comes along with it, hopefully we can truly discover the most beneficial way for people to encode information so as to ensure they will remember it again.

BIBLIOGRAPHY

Bower, G. H. & Clark, M. C. (1969). Narrative stories as mediators for serial learning, *Psychonomic Science, 14*(4), 181-182. doi:10.3758/BF03332778

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal behavior,* 11, 671-684. doi:10.1016/S0022-5371(72)80001-X

Kang, S. H. K., McDermott, K. B., & Cohen, S. M. (2008). The mnemonic advantage of processing fitness-relevant information. *Memory and Cognition, 36*(6), 1151-1156. doi:10.3758/MC.36.6.1151

Nairne, J. S., Josefa N. S. Pandeirada, & Thompson, S. R. (2008). Adaptive memory: The comparative value of survival processing. *Psychological Science, 19*(2), 176-180. doi:10.1111/j.1467-9280.2008.02063.x

Otgaar, H. P., Smeets, T., & van Bergen, S. H. E. M. (2010). Picturing survival memories: Enhanced memory after fitness-relevan processing occurs for verbal and visual stimuli. *Memory & Cognition, 38*(1). doi:10.3758/MC.38.1.23

Reysen, M.B., Reysen, R. & Joyner, A. (2020). The Effects of Story Processing on Recall Performance. Manuscript in Preparation.

Van Overschelde, J.P., Rawson, K.A., & Dunloksy, J. (2004). Category norms: An updated and

Expanded version of the battig and montague (1969) norms: *Journal of Memory and Language, 50*(30), 289-335. doi:10.1016/j.jml.2003.10.00

Weinstein, Y., Bugg, J. M., & Roediger III, H. L. (2008). Can the survival recall advantage be explained by basic memory processes? *Memory & Cognition, 36*(5), 913-919. doi:10.3758/MC.36.5.9

Figure 1

Mean Recall Across Conditions

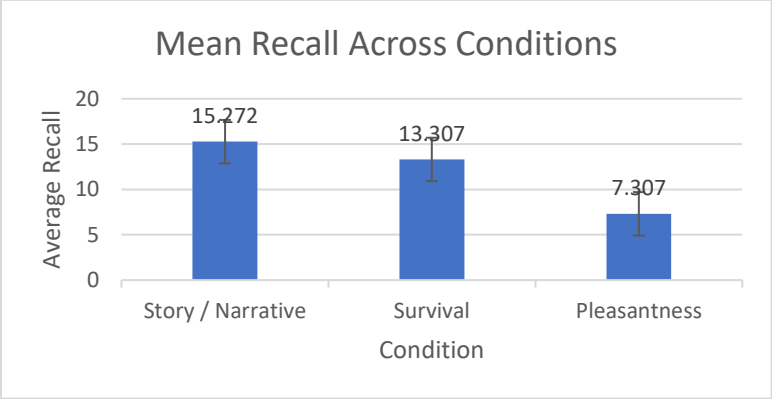

Figure Note: This figure exhibits the mean recall across the three different conditions. Average recall score is represented on the y-axis and condition on the x-axis. Error bars represent standard errors.

Figure 2

Average Intrusions Across Conditions

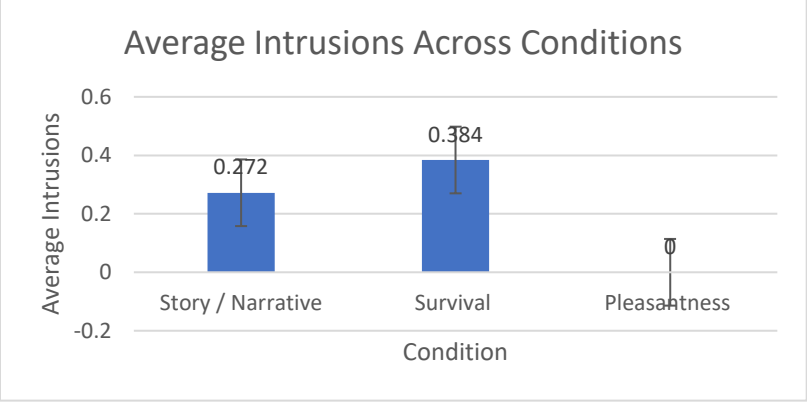

Figure Note: This figure displays the average intrusions across the three different conditions. Average intrusion score is represented on the y-axis and condition on the x-axis. Error bars represent standard error.

Figure 3

Average Rating Across Conditions

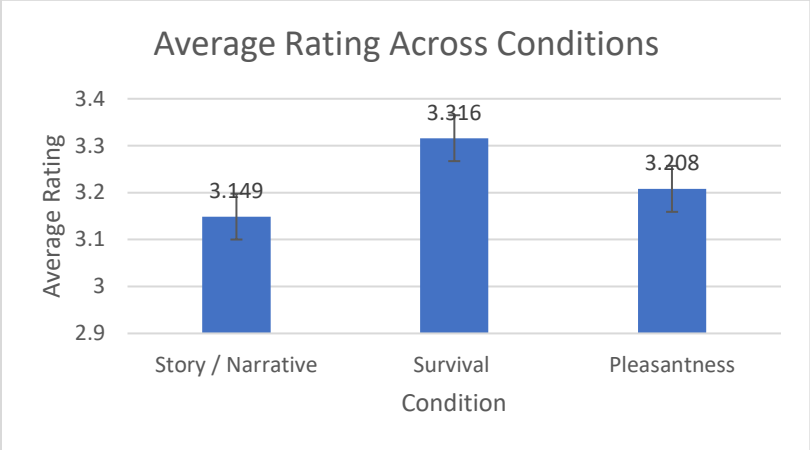

Figure Note: This figure illustrates the average rating across the three different conditions. Average rating is represented on the y-axis and condition on the x-axis. Error bars represent standard error.

Figure 4

Average Reaction Time Across Conditions

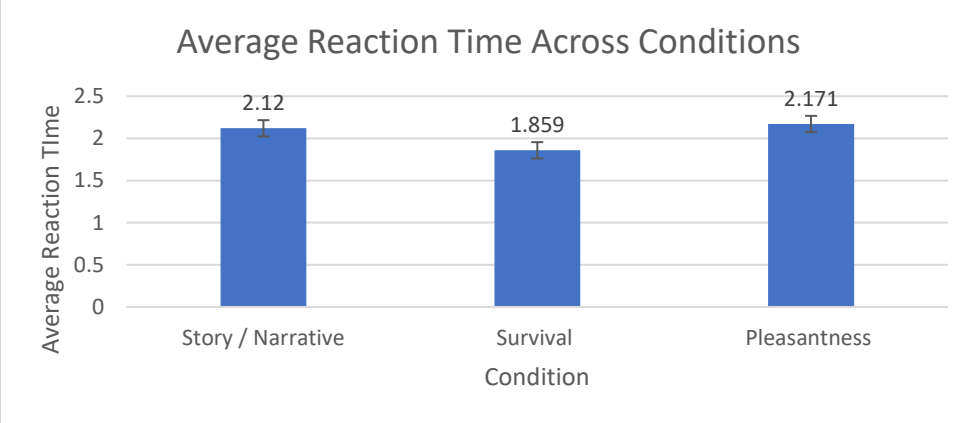

Figure Note: This figure presents the average reaction time across the three different conditions. Average reaction time is represented on the y-axis and condition is represented on the x-axis. Error bars represent standard error.