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The extent to which "death and disgust" thoughts influence recall in survival processing scenarios

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The extent to which “death and disgust” thoughts influence recall in survival processing scenarios

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ABSTRACT

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Recently, researchers have found that survival processing enhances retention (Nairne, Thompson, and Pandeirada, 2007). This led the authors to speculate that our memory systems have been fine tuned to remember survival relevant information. One question that might be asked is what is it about thinking about one’s survival that aids memory? As an extension of my previous research, this project examines the extent to which death and disgust influence recall in survival processing scenarios, determining whether or not death and disgust play a role in the memory enhancement associated with survival processing scenarios. There are four conditions in this study differing in the amount of death and disgust involved in each of the scenarios. The results of the study showed that there was no difference in retention between the four conditions, including the control condition. While a manipulation check determined that death and disgust was adequately manipulated, the recall results showed no effect of death and disgust on memory. This leads me to tentatively conclude that death and disgust is not one of the mechanisms responsible for the memory improvement seen in survival research.

The extent to which “death and disgust” thoughts influence recall in survival processing scenarios

Are human beings equipped to remember survival relevant information? In 2007, Nairne, Thompson and Pandeirada investigated the idea that memory systems may have evolved to help us remember information relevant to survival. They proposed that processing material, such as a list of words, in terms of its relevance to survival should improve retention if as they suggested, our memory systems have evolved to help us remember fitness relevant information. To test their hypothesis, they compared tasks focused on survival to control conditions unrelated to survival, but that have been previously shown to promote deep semantic processing. In their first experiment, participants were asked to rate 30 unrelated words on one of three different dimensions. In the survival condition, participants had to rate words in terms of how relevant they were to a survival scenario. In this scenario, participants were asked to imagine themselves being stranded in the grasslands of a foreign land without any basic supplies. The reason why the grassland scenario was used is because of the importance of ancestral environments in evolutionary reasoning; our brains contain numerous adaptations that are dedicated to helping us solve specific problems that arose in our ancestral past. Thus, these adaptations are likely to be most beneficial when the environment is most similar to the one in which the adaptation originally occurred (Cosmides & Tooby, 1992; Weinstein, Bugg and Roediger, 2008). In the second condition, the moving control condition, participants were asked to imagine they were planning to move to a new home in a foreign land and their task was to rate the relevance of each word to finding and moving to a new home. The final condition was a pleasantness rating condition which has been shown to be an especially effective deep processing condition (e.g. Hunt & Einstein,

1981). The participants were asked to rate the pleasantness of each word. After a short period of distracter activity following the rating task, unexpected free-recall of the words was tested. Results showed that survival-based processing yielded the best retention. Their analyses additionally ruled out the possibility that the retention benefit was due to differences in the numerical ratings of the words or the amount of time required to rate the words. Nairne et al. (2007) proposed that our memory systems are predisposed to remember information that is relevant to survival.

Since the publication of Nairne and colleagues (2007) study, the survival processing task has been compared to a wide number of control conditions. Nairne, Pandeirada, and Thompson (2008) compared survival processing to conditions that are universally accepted as producing superb retention. These included conditions in which participants were asked to rate words for their pleasantness, their image-ability, and their self-relevance. Some participants were also asked to study words with the intention of learning them for the purpose of being asked to recall them later, and some participants rated words for relevance to a vacation situation – a contextually rich, but non-survival related scenario. The overall results provided convincing evidence for the power of survival processing as a mnemonic aid. A condition that required a simple decision about the relevance of random words to a survival scenario produced significantly enhanced retention relative to standard deep processing controls and to contextually rich non-survival relevant controls. With this in mind, Nairne et al. (2008) concluded that survival processing is one of the best encoding procedures identified in human memory research.

Kang, McDermott and Cohen (2008) compared the survival scenario to the planning of a bank heist. Participants in the robbery condition were told that they were in

charge of leading the heist of a well-guarded bank and over the next few months they were to find people to help them, make a plan, and gather any necessary supplies. This condition was supposed to match the survival processing condition in terms of level of arousal, novelty, and media exposure. The results showed that the survival processing condition produced superior recall and recognition, suggesting that neither novelty nor arousal could explain the significant survival memory benefit. In the second experiment, Kang et al. (2008) demonstrated the same benefit of survival processing could be achieved when considering the survival of others. This shows that an explicit contemplation of one’s own survival may not be necessary to produce the survival effect.

Otgaar, Smeets and Van Bergen (2010) examined whether the recall advantage also holds for other classes of stimuli, such as pictures. If the survival processing effect is the result of an adaptive process, processing pictures should also create a mnemonic benefit since the latter proceeded the processing of language in human evolution (Paivio, 2007, as cited in Otgaar et al., 2010). Therefore, from an evolutionary standpoint, the survival effect might even be larger for pictures than for words. In their first experiment, participants were randomly allocated to a survival, moving, or pleasantness scenario identical to that used by Nairne et. al. (2007). However, half of the participants were presented with pictures instead of words to rate for their relevance to the respective scenario. Then, all participants were given a surprise recall test. Their findings showed that the survival recall advantage was present when pictorial stimuli were used, but pictures did not benefit more from survival processing than did words. Although pictures did not produce a larger effect than words, an effect was still present. Therefore, their results supported the general hypothesis that memory has evolved to favor fitness-

relevant information. The mnemonic benefit of survival processing appears to be a robust phenomenon, and this study further validates the functional–evolutionary approach to studying memory.

Weinstein, Bugg, and Roediger (2008) suggested that evaluating words for their relevance to the survival scenario may produce greater schematic processing than does rating words for pleasantness or other scenarios that have been used. This schematic processing difference might be a reason why survival processing generates a significant memory improvement over all the other conditions used in previous research. To test this hypothesis they replicated the effect by comparing the ancestral survival condition to a city survival condition. The two scenarios involved were almost identical in wording except for two words. “In this task we would like you to imagine that you are stranded in the grasslands (city) 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 (attackers)” (Weinstein et al., 2008). Their hypothesis stated that the ancestral condition should produce better retention if human memory systems have been shaped by evolution. Specifically, according to evolutionary reasoning, adaptations evolved to solve particular problems in particular environments, and thus those adaptations would be more beneficial (or efficient) in environments similar to those in which they evolved. Their findings supported this evolutionary perspective; the ancestral survival condition produced better memory than the modern survival condition. The results question the idea that the survival processing effect is due to a difference in the amount of schematic processing that occurs because both conditions were schematically the same.

Nairne and Pandeirada (2010) further investigated whether ancestral environments produced a larger survival processing effect than more modern ones. In one experiment, participants were told to imagine they had been hurt and a dangerous infection might be developing. Their task was to search and find relevant medicinal plants in an attempt to cure the infection (the ancestral scenario) or to find relevant antibiotics (the modern scenario). In a second experiment, they asked participants to search for food by gathering edible plants in the grasslands (ancestral scenario) or imagine gaining needed nourishment by searching for and buying food in a city (modern scenario). Their findings were consistent with previous findings; the results of both experiments showed a significant mnemonic advantage for the ancestral survival condition over the modern survival condition. These findings, along with the previous findings of Weinstein et al. (2008) seem to suggest that our memory systems have been shaped to better remember information that stems from an ancestral (vs. modern) scenario.

Klein, Robertson and Delton (2010) state that the adaptive function of our memory systems is to support and inform future decisions. Information about the past is stored in order to use it to plan for the future. In their study, a survival orienting task was compared to a set of encoding tasks that differed with respect to the temporal orientation (past, atemporal, and future) that the participants were encouraged to take while they processed a list of words. All of the participants were asked to imagine being in the woods. The survival-oriented condition was given a scenario very similar to Nairne and Pandeirada’s (2007) survival scenario. In the past-oriented camping condition, the participants were instructed to recall a specific time in their past when they went camping

in the woods and then to determine whether each item in the list was part of their memory of the recalled experience. In the future-oriented camping condition the participants were asked to imagine that they were planning to go camping and then to decide whether each of the items in the list was relevant to planning their trip. In the last condition, the atemporal condition, the participants were asked to use their non-personal, semantic knowledge of camping to form an image of a camping trip and then to decide whether each item was part of their representation. In this condition, no mention was made of the temporal context. Following encoding, the participants received a surprise recall test. The authors predicted that the task designed to encourage planning in the future (i.e., the planning task) would produce reliably higher recall of list items than would either the past-oriented or the atemporal task. Their findings were consistent with their predictions; future-oriented planning resulted in better memory than all of the other conditions, including the survival processing condition. Their results agree with the argument that memory systems use the past to serve the future and when memory is used for the purpose it was designed, it will be particularly efficient in those conditions. One of the main things that allow us to survive is planning for the future. So evolutionarily wise, we have evolved features, particularly memory features, to help us plan; when planning is properly engaged, memory performance is predominantly efficient.

It is not entirely clear why the future camping group produced better recall than the survival processing group. Klein et al. (2010) suggested that the future camping scenario involved more planning than the survival scenario. However, it is also possible that thinking about the supplies one might need while camping in the forest might instill thoughts of survival.

Previous research has been able to rule out many different proximate mechanisms to explain the survival processing advantage (e.g. novelty, arousal, schematic processing). However, very little has been revealed about the proximate mechanisms that actually produce the survival benefit. Nairne and Pandeirada (2008) tested the survival effect using a categorized list. In two experiments, participants were asked to make survival relevance decisions about words from a categorized list that were inherently survival related, such as animals, fruits, vegetables, and human dwellings. In a separate control condition, participants were asked to make pleasantness ratings about exactly the same items prior to the surprise recall test. Results showed that survival processing still produced the best recall performance, despite the fact that rating categorically related words in terms of how pleasant they are has been thought to be the best procedure for maximizing free recall (see Nairne & Panderiada, (2008) for a discussion). However, Butler, Kang and Roediger (2009) argued that in Nairne and Pandeirada's (2008) study the effect was due to congruity since they used words highly related to survival. As a result, Butler, Kang and Roediger (2009) investigated the congruity effect, the finding that shows that items are better remembered when they fit better with the encoding condition. For example, if the words rated were all names of different colors and the scenario asked the participants to rate the words on how bright or dull they are, it is likely that memory would be enhanced simply because the word items and scenario are highly related. Similar to Kang et al. (2008), they compared the survival scenario to the bank heist scenario. They used 3 categorized lists of words; one list of words was relevant to the survival scenario, the second list of words was relevant to the robbery scenario, and the third list of words was irrelevant to both scenarios. Their results revealed that the

survival advantage was large when the list of words was relevant to survival. However, the effect disappeared when the items were irrelevant to both scenarios, and the bank heist condition actually outperformed the survival processing condition when the list of words was relevant to the bank scenario only. Therefore, Butler and colleagues (2009) suggested that when the material is carefully controlled with respect to congruence between type of processing and the list of words, survival processing does not always produce superior recall. Their findings suggest that the congruity effect restrains the generality of the survival processing advantage (Butler et al., 2009).

Nairne and Pandeirada (2010) revisited Butler, Kang and Roediger’s (2009) proposal that the congruity between target items and processing tasks might explain the retention benefit for survival processing. They replicated the results of Butler et al. (2009) using the same encoding conditions while changing some details in the experimental design. Their first experiment tested whether the survival advantage generalizes to a wide sample of words. In the second experiment, participants received only words that were irrelevant to their encoding condition (survival or robbery). In the third experiment, only congruent words for the assigned scenario were used. In the fourth experiment, participants were asked to rate words on their relevance to either the survival or robbery scenario where the words were either congruent or incongruent to the assigned condition. Counter to Butler and colleagues (2009) results showing a null effect of survival processing, a significant survival processing advantage was achieved in all four experiments. However, the survival advantage for the congruent words did not reach significance. Nairne et al. (2008) suggested that Butler and colleagues results might not generalize beyond their particular experimental design. They may have reached the

conclusion they came to because the list of words they used was more incongruent than congruent to the assigned scenario. Regardless, both studies showed the powerful effect of congruity; processing words that are congruent with the encoding condition significantly improve later recall. However, Nairne et al. (2008) also showed that congruity could not explain the survival processing effect.

Four years after Nairne et al. (2007) published their discovery of the survival effect, Burns Hwang, and Burns (2011) were able to determine at least one set of proximate mechanisms responsible for this memory advantage. They argued that the mnemonic advantage of the survival task is due to the combination of item-specific and relational processing. They aimed to show that the survival effect is present when survival processing is compared to conditions that use only one type of processing (item-specific or relational), but eliminated when the control encoding condition promotes both types of processing simultaneously.

Item-specific processing is defined by the encoding of individual characteristics of each item, or word. With item-specific processing, each item has its own retrieval cue(s) which leads to a greater ability to discriminate between each item. Relational processing refers to encoding items into groups sharing similar characteristics. This type of processing improves retention because it provides a structure between words, creating organized retrieval. I note here that the pleasantness rating task is known to induce item-specific processing (see Hunt & Einstein, 1981). It is also known that using categorized lists of words inherently promotes relational processing. Therefore, Burns et al. (2011) thought to use pleasantness rating with a categorized list of words as one of their control tasks, thereby promoting both types of processing where recall performance should be

superior to any conditions involving only item-specific or relational processing. Their second control condition was a category sorting task, which is known to promote relational processing (Hunt & Einstein, 1981). This group was expected to perform only relational processing. Thus, the pleasantness rating of a categorized list was presumed to encourage both item-specific and relational processing, the category sorting condition presumably encouraged relational processing, and it was expected that the survival processing condition would encourage both types of processing. The results showed that when survival processing was compared to the category sorting group, which presumably processed only one type of information, the survival mnemonic advantage was present. However, when it was compared with a control condition that promoted both types of processing (pleasantness rating), the retention advantage disappeared. The results strongly suggest that the survival processing effect occurs from using both types of processing, whereas most control tasks encourage only one type of processing. From their results, the authors were able to suggest a possible proximate mechanism responsible for the survival processing effect.

In a different, but potentially related line of research, Hart and Burns (in press) discovered that thinking about death enhances retention on a subsequent memory task. They reasoned that it seems logical that human beings’ awareness of their own death is an evolutionary adaption because dying is the chief threat to an individual’s chances of reproduction. Hart and Burns (in press) hypothesized that survival orientation is most likely a mortality salient state since thinking about survival includes thoughts about avoiding death. Therefore, the authors questioned whether the mere thought of dying might enhance memory. Their first experiment tested this hypothesis by testing whether a

mortality salient manipulation would improve recall for a subsequently presented list of words rated for pleasantness. Participants were randomly assigned to a mortality salience condition or a control condition, watching television. They were asked to describe the emotions that the thought of either dying or watching television evoked and to, “Jot down, as specifically as you can, what you think will happen to you as you physically die [watch television] and once your are physically dead [have watched it]” (Hart & Burns, 2011). After a short task in which the participants completed the Positive and Negative Affect Schedule (PANAS), they rated the pleasantness of 48 unrelated words. Then, after a delay of 1 min, the participants were given a surprise recall test. The results supported Hart and Burns’ hypothesis; the mortality salience participants recalled more words than participants primed with television. Experiment 2 was a replication of Experiment 1, except a larger, more diverse sample was used and the comparison condition was designed to control for negative affect and arousal. Participants were randomly assigned to the mortality salience condition or a control condition, which asked the participants to think and write about becoming physically paralyzed. Then they rated the pleasantness of a list of 32 unrelated words instead of the 48 words given in Experiment 1. The rest of Experiment 2 was a direct replication of Experiment 1. As predicted, the mortality salience group led to better recall than the paralysis salience group, which suggests that there is something distinctive about the mortality salient state that cannot be explained in terms of affect or arousal. In Experiment 3, Hart and Burns (in press) tested whether mortality salience would improve retention following an intentional learning task. Participants were randomly assigned to either the mortality salience condition or a control condition. In this experiment the control condition used was experiencing dental pain.

After writing about death or dental pain, the participants completed the PANAS. They were then shown a series of 36 words on a computer screen, for 5 s each, that they were told to try and remember for a memory test. They were then asked to recall the words. The results again supported Hart and Burns’ hypothesis; participants primed with mortality salience recalled more words than participants primed with dental pain. This evokes the question of how much thinking about death relates to the survival processing memory benefit.

An unpublished study by Burns and Hart compared the mortality salience effect to survival processing. Two primes were used (death or dental pain) and two encoding conditions (pleasantness or survival processing) were used. At the beginning of the study, the participants were asked to either think about their own death or think about having dental pain. Half the participants in each prime were then split into a survival group and a pleasantness group. The survival group was given the typical scenario about being in the grasslands and needing to survive, and then rated a list of words in terms of how relevant they would be to their own survival. The pleasantness group was asked to rate the list of words in terms of how pleasant they were to them. The two groups were unaware that they were going to be asked to recall the words later in the experiment. The study showed that death priming produced better memory than dental pain priming for the pleasantness condition, but for the survival scenario death priming was equivalent to dental pain priming. This elimination of the “death effect” for the survival processing conditions suggests that thinking about death is related to thinking about the survival value of words; death priming does not improve memory beyond the improvement obtained by survival processing, suggesting that the two effects may be based on the same mechanisms. No

clear proximate mechanisms were pinpointed, and more research is needed to elucidate what the mechanism(s) may be.

Soderstrom and McCabe (2011) published a study that compared an ancestor-consistent scenario and a modern survival scenario that involved threats from human ancestors (predators) or threats from fictitious characters (zombies). As mentioned earlier, it has been shown that inducing scenarios specifically faced by our ancestors should lead to better recall than more modern scenarios (Weinstein et al., 2008). This study reexamined this hypothesis. A between-subjects design was used in which participants were randomly assigned to one of the five rating scenarios. The first scenario was a grassland-predator scenario where the task was the typical survival-processing scenario, rating a list of words in terms of survival, identical in wording to the survival scenario used by Nairne et al. (2007). In the second scenario, the grasslands-zombie scenario, the wording was identical, except the word predators was replaced with the word zombies, therefore having this group imagine that they must protect themselves from zombies. For the third scenario, the city-attacker scenario, the words grasslands and predators were replaced with city and attackers and the wording was identical to the city survival scenario used by Weinstein et al. (2008). For the fourth scenario, the city-zombie scenario, the wording was identical to the city-attacker scenario, except the word attacker was replaced with zombie. In the fifth condition, the participants rated the list of words in terms of their pleasantness, which was identical in wording to the instructions used by Nairne et. al. (2007). Each participant was presented with a randomized list of words and they were asked to rate each word on a 5-point scale, ranging from totally irrelevant to totally relevant. For the pleasantness ratings, the were asked to rate the words on a 5-

point scale in terms of their pleasantness, ranging from extremely unpleasant to extremely pleasant. After filling out a demographic questionnaire for 2 min, they were given a surprise recall test where they were asked to recall on a response sheet, in any order, the words they rated earlier. The results showed that the scenarios with zombies as a threat elicited a higher recall than those with predators/attackers, regardless of whether the scenario was in the grasslands or a city. When they looked at the effects of arousal, the participants with the threat of zombies were more aroused than those with the threats of predators/attackers. Additionally, the scenarios with zombies as the threat were rated as more negative than the predators/attackers scenarios. Even though the zombie scenarios were more arousing and more negative, follow up tests show that these differences did not account for the recall differences between scenarios. Their findings showed that ancestral environments have no specific advantage in regards to encouraging a survival related memory increase. The authors suggested that perhaps the survival scenarios that included zombies led to the activation of “death and disgust systems” which makes the threat more noticeable and important (Soderstrom & McCabe, 2011).

The results of the previous research, particularly Hart and Burns (in press) and Soderstrom and McCabe’s (2011) study, has led to the current study examining the extent to which death or “death and disgust” thoughts influence recall in survival processing scenarios. There were four conditions in the study, whereby the amount of “death and disgust” involved in each of the conditions was manipulated. Each participant was then given a list of words to rate in terms of relevance to their given scenario. Then, they were given a 2 min distracter task before they were asked to remember the words. The results of the study could have many implications. First, we expect all of the survival scenarios

to produce recall superior to that of the pleasantness control condition. Second, if there is no difference between the three “death and disgust” conditions, then I could conclude that the amount of death involved in each of the scenarios has no effect on memory improvement. If, on the other hand, the scenario with the highest level of death and disgust has the greatest recall, then it would imply that the extent to which death and disgust is involved in a scenario improves recall. This would provide strong support for the view that survival processing is intricately related to thoughts of death. With this intended outcome, it would give insight into one of the mechanisms responsible for the improvement of memory in survival research.

Method

Participants

One hundred and twenty-six psychology undergraduate students participated either for credit toward a class requirement or for $6 cash. Seven subjects' data were dropped because they failed to follow proper instructions.

Materials and Procedure

Tested individually in small group sessions, participants were randomly assigned to one of three survival scenarios differing in the degree to which they involved "death and disgust" or to a control condition involving a moving scenario. Participants were first asked to fill out a contingency of self-worth questionnaire (CSW), answering 10 questions on a scale of 1 to 7 to the degree to which they agree or disagree with the statement (see Appendix A). Five questions were geared toward academic competitiveness and five questions were geared toward general competitiveness. This questionnaire was included to see whether competitiveness plays a role in the number of words the participants' recall. They were then read the instructions pertaining to one of the four conditions, with the first condition (the low death group) as follows:

> "We would like you to imagine that you are stranded in the grasslands of a foreign land. Over the next few months, you'll 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 – its up to you to decide. To help you perform this task, we would like you to imagine yourself in this situation and then try to form a vivid

image in your mind where you are seeking food and shelter when you first notice a zebra, and then spot a hungry lion nearby."

In the second scenario, the medium death group, the wording was identical except "dead, rotting" was added in front of the word zebra. The third scenario, the high death group, was identical to the second except "the bloody remains of" was added in front of the dead, rotting zebra. The control group was given a moving scenario and they were asked to rate the words in relation to how relevant they were to moving to a new home in a foreign land. Each participant was given 10 s to form the image.

Next, participants rated the relative relevance (1 = *extremely irrelevant*; 4 = *extremely relevant*) that each word in a list of 48 unrelated words had to their scenario. They rated the words by using the keyboard on the computer (see full list of words in Appendix B).

The words were shown for 6 s each. As a 2 min distracter task following word presentation, participants completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) so it could be determined whether or not there were any "death and disgust" effects on recall because of negative or positive affect (NA or PA; see Appendix C). In previous research, affect did not play a role (e.g., Hart & Burns, in press). After the PANAS, the participants were given 7 min to recall the words. The number of words recalled every minute were recorded, so the number of words they remembered, on average, in a given amount of time could be measured. Next, to determine if survival processing affects memory for the temporal order of the words presented, the participants were then given a reconstruction test. This allows for an assessment of their memory for the order in which the words were presented as well as

for the words themselves. After the reconstruction test, the participants filled out a demographic questionnaire that asked 7 additional questions about the image the participants were asked to imagine by circling the appropriate number on a 10-point scale. The questions had them rate the scenario on complexity, vividness, gruesomeness, relatedness to death, frightfulness, sadness, and excitability. A copy of the questionnaire is in Appendix D.

Results

The results of the CSW questionnaire revealed that all the groups were roughly equal in terms of their competitive tendencies, and thus no particular group was likely to try harder than any other (means reported in Table 1). This conclusion was supported by two one- way analyses of variance (ANOVA) conducted on the general competitiveness and academic competitiveness scores, which revealed that there was no significant difference as a function of group, $F(3,120) = .603$, $p = .613$ and $F(3,120) = .482$, $p = .696$ respectively.

Table 1

Mean PANAS Scores and CSW Scores for the Four Conditions.

	PANAS		CSW	
Scenario	Positive	Negative	General	Academic
Low Death	2.713	1.690	5.097	5.252
Medium Death	2.513	1.627	5.367	5.180
High Death	2.666	1.511	5.314	5.223
Moving	2.796	1.564	5.250	5.086

The PANAS scores revealed that neither positive or negative affect differed between the four conditions, which suggests that no particular scenario altered mood either positively or negatively, $F(3,120) = .696$, $p = .556$ and $F(3,120) = .741$, $p = .530$ respectively (means reported in Table 1). The means for the rating scores and response times across all four conditions are reported in Table 2. A one-way ANOVA was conducted on the rating scores and revealed that there was no difference in reaction time as a function of group, $F(3, 119) = 1.04$, $p = .379$. A similar one-way ANOVA conducted on response times and revealed that there was no difference in response time as a function of group, $F(3,119) = .17$, $p=.917$. Therefore, no differences that may be found in recall can be due to rating score or reaction time score differences.

Table 2
Mean Rating Scores and Reaction Times for the Four Conditions.

	Rating Scores and Reaction Times	
Type of Scenario	Rating Scores	Reaction Time (ms)
Low Death	2.148	2094.069
Medium Death	2.042	2049.984
High Death	1.978	2077.110
Moving	1.997	2086.330

When the 7 questions from the questionnaire asking about the scenarios were analyzed (means reported in Table 3), the questions asking about complexity, vividness, and excitability of the image they formed did not differ. Three ANOVA's were

conducted and there were no significant differences, largest F=1.472. For the other four variables (gruesomeness, fearfulness, sadness, and death), I found significant differences between each scenario (see Figures 1,2,3 and 4). The ANOVA for each was significant, F (3, 119) = 40.725, p = .000, F(3, 119) = 4.685, p =.004, F(3,119) = 14.309, p =.000, F(3,119)=10.099, p=.000 respectively, for gruesomeness, fearfulness, sadness, and death. Follow-up least significant difference (LSD) tests were conducted and revealed that for gruesomeness, the moving (control) scenario was rated the least gruesome followed by the low death group, then the medium death group, and then the high death group. The same outcome was obtained for the death question, with the exception that the difference between low death and medium death groups did not reach significance. Thus, the degree of gruesomeness and death in the scenarios were manipulated well. For the fearfulness and sadness questions, I found that the moving scenario was lower than the three death groups, but there was no significant differences between the three death groups. This is also what I expected to find since the death manipulation should not produce a difference in fearfulness or sadness.

Figure 1.
Mean gruesomeness rating across all four scenarios.

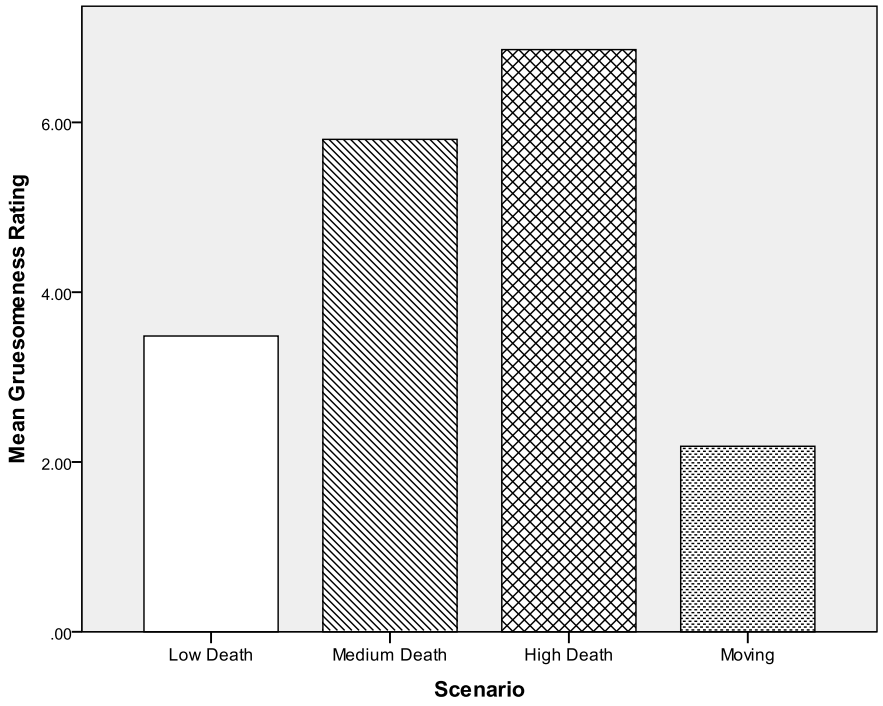


Figure 2.
Mean fearfulness rating across all four scenarios.

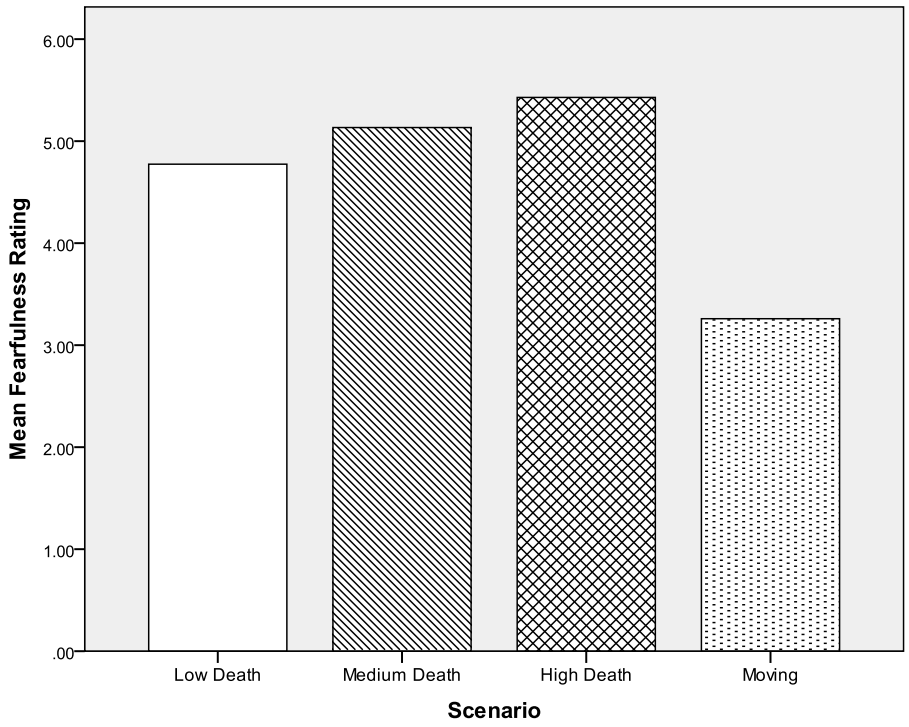


Figure 3.
Mean sadness rating across all four scenarios.

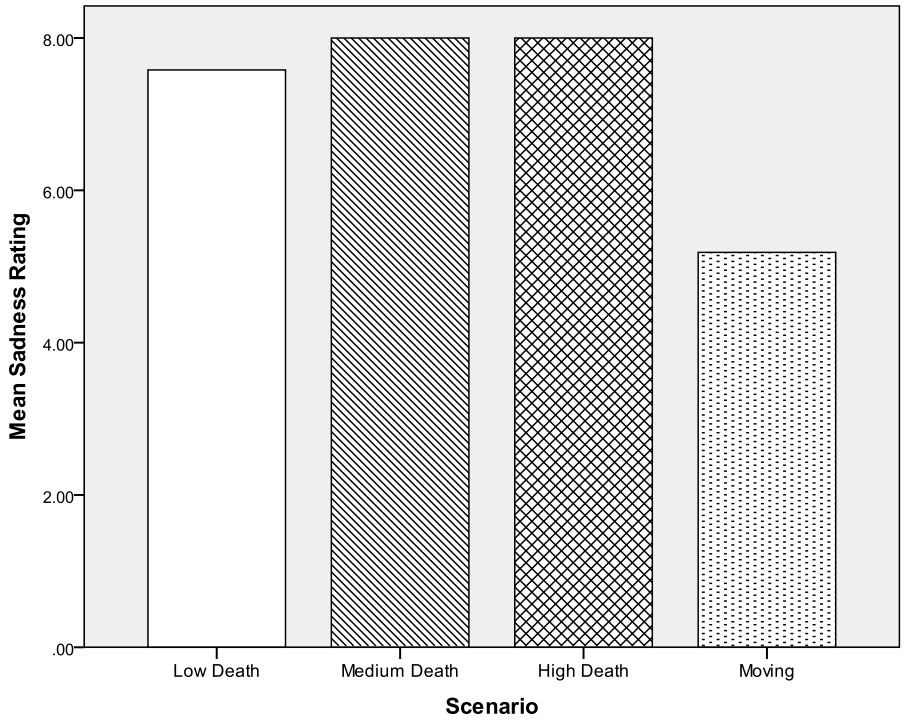
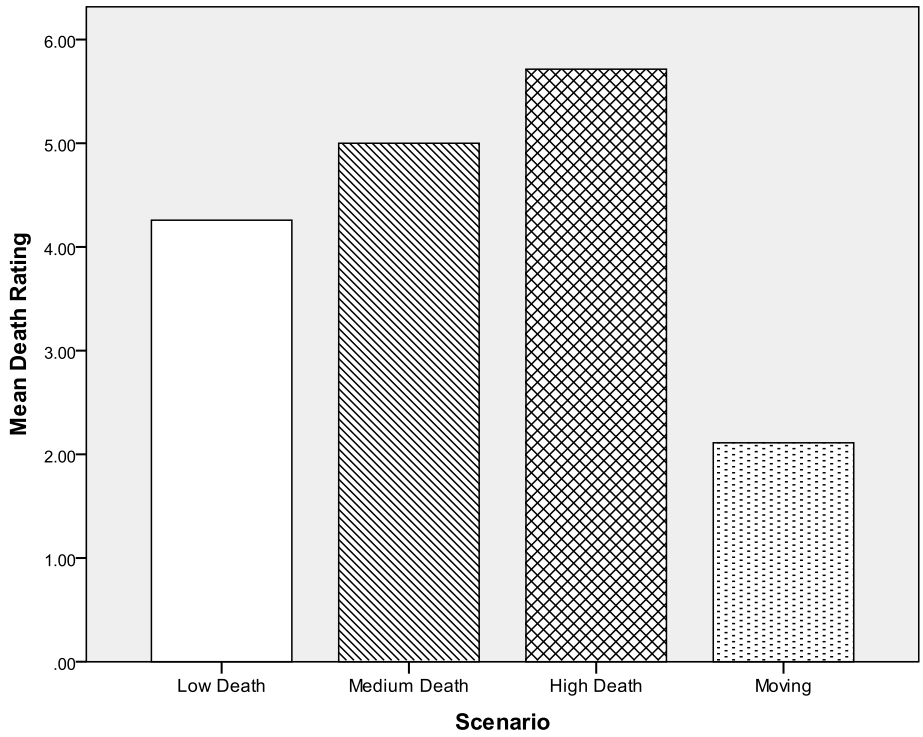


Figure 4.
Mean death rating across all four scenarios.



Contrary to my hypothesis, there was no difference between conditions on either the recall or order scores. As can been seen in figures 5 and 6, there was very little difference in recall or order reconstruction scores across groups. One-way ANOVA’s were conducted on the recall and order reconstruction scores. They revealed no significant difference in recall as a function of group, F (3,119) = 1.454, p = .231 and no significant difference in order reconstruction as a function of group, F (3, 118) = 1.42, p = .241.

Table 3
Mean Scenario Ratings on Seven Dimensions.

	Seven Dimensions						
Type of Scenario	Complex	Vivid	Gruesome	Death	Fearful	Sadness	Excited
Low Death	4.290	5.419	3.284	4.258	4.774	7.581	3.903
Medium Death	5.133	5.933	5.800	5.000	5.133	8.000	3.900
High Death	4.800	6.371	6.857	5.714	5.429	8.000	3.800
Moving	4.370	5.778	2.185	2.111	3.259	5.185	4.482

Figure 5.
Order reconstruction task scores across all four scenarios.

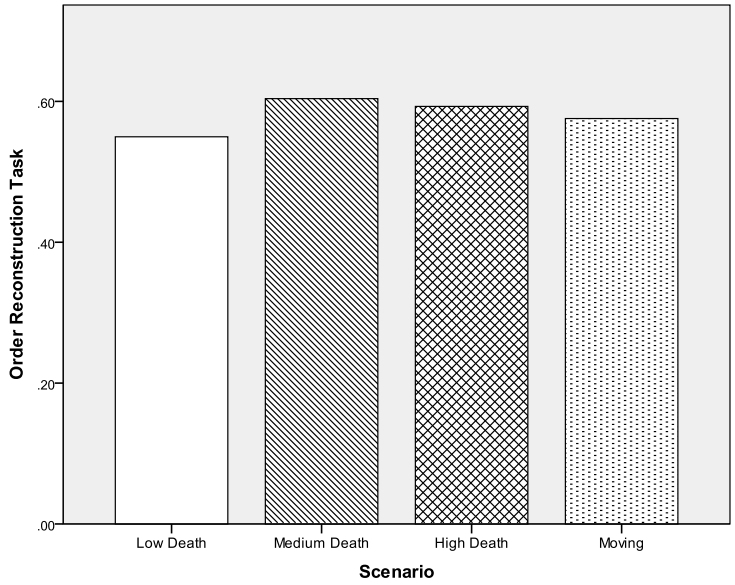
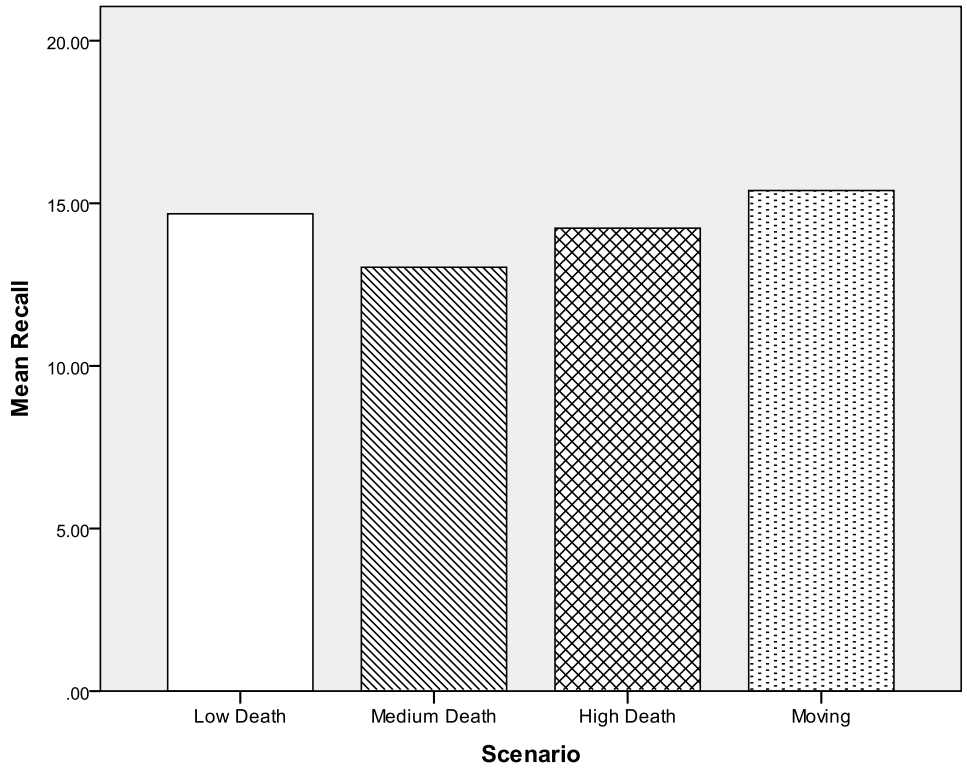


Figure 6.
Mean recall scores across all four scenarios.



Discussion

Contrary to my hypothesis, thoughts of “death and disgust” did not enhance retention in the typical survival processing scenario. Additionally, the moving control condition, which should have produced significantly lower recall than the survival processing condition, did the opposite; participants in this group did numerically better than the three survival (death) processing conditions. Despite the fact that the typical survival processing effect was not replicated, the gruesomeness and death manipulations were done well. Participants in the high death group rated the amount of gruesomeness and death present in the scenario significantly higher than the medium death group and people in the medium death group rated the amount of gruesomeness and death higher than the low death group, although the latter comparison was significant only for

gruesomeness. Even with a seemingly effective manipulation, there did not seem to be any effect on recall.

The main concern of the current study was that the typical survival processing effect was not replicated. One possibility for why the moving group did just as well as the other three groups is because there may be a survival component involved when thinking about moving to a new home in a foreign land. While this may be possible, it does not explain why other studies have replicated the typical survival processing effect using a moving group as a control (e.g. Otgar et. al., 2010). However, the majority of survival processing research studies have used a pleasantness rating condition as a control group. It would be interesting to see all of the unpublished research that may have results similar to the current outcome. It is possible that survival processing does not always produce better recall than a moving scenario.

It is also a possibility that asking the participants to imagine the scenario they were in actually played more of a role in recall than I originally thought. The one thing done differently in this study (vs. other survival processing studies) is that there was a forced imagery component involved. Having the participants form an image of the situation described in their scenario may eliminate the survival advantage. For example, the participants may have used something similar to the method of loci mnemonic, placing the words on the list that they were asked to rate in different locations within the imagined scenario, and it is possible that this mnemonic device offset the effect of survival.

Another possibility for why the moving scenario did as well as the survival processing conditions may be due to the traveling experience of the student population at Union College. Many of the students who sign up to participate in psychology studies are either foreign exchange students or have studied abroad in a foreign country and thus are familiar with travel. This extra-familiarity that many of the participants had may have actually aided them in remembering the words in the moving scenario. It is possible that students at other colleges where survival studies have been conducted (e.g., Purdue University) may have far less travel experience.

Ignoring the results of the moving control group in this study, the remainder of the data lends some evidence that thoughts of "death and disgust" is not really what is responsible for the survival processing effect. While this conclusion is tentative because the typical survival processing effect was not replicated, it is worth exploring. The hypothesis that "death and disgust" may have something to do with the memory benefit seen in survival processing scenarios stems from the study done by Soderstrom and McCabe (2011). In their study, the results showed that the scenarios with zombies as a threat elicited higher recall than those with predators/attackers. A possible reason that the zombie condition may have produced better recall was because they prompted the subjects to have thoughts of "death and disgust" and thus it is "death and disgust" thoughts that lead to the actual memory improvement resulting from the typical survival processing effect. However, the current study's results seem to suggest otherwise. While it must be noted that the typical survival processing effect was not replicated in this study, there was still no memory improvement within the three survival groups suggesting that increases in "death and disgust" do not improve recall. Thus, it is

possible that the reason the zombie scenario groups did better was due to something other than "death and disgust".

One possible explanation for the survival processing effect is that arousal has something to do with it. In Soderstrom and McCabe's (2011) study, the participants with the threat of zombies were more aroused than those with the threats of predators/attackers. While the difference was not statistically significant, it may give insight into one of the mechanisms involved in the memory improvement resulting from the typical survival processing effect. Two other possibilities that may explain why the zombie groups produced better recall have to do with the novelty of the zombie and the strong imagery the thought of the zombies invokes. Future research may want to manipulate either novelty or imagery to see if they have an effect. However, there is already some evidence that novelty is not responsible for memory improvement (Butler et al., 2009). Less is known about imagery as a possible mechanism, but, it is interesting to note that in the current study the participants were purposely asked to use imagery in all four groups and all four groups did just about the same in terms of recall.

A limitation of the current study is the possibility that the manipulation of the three survival groups was not strong enough. Although subjects rated the higher death scenarios as more gruesome and death oriented, it still could be argued that a stronger manipulation of "death and disgust" may produce an effect. One suggestion for a stronger manipulation would be to replace the dead zebra in the scenario with a dead human. The reason why a dead human would be a stronger manipulation is because it is more relevant to the participants' own death or survival than a dead zebra, which may also increase the participants' conceptual awareness of death. A potential problem with the dead zebra

scenario is that it did not invoke any sense of self-relevance, which may be an important factor in improving recall. Further research could test this hypothesis.

It is interesting to examine the current findings in terms of the findings of Hart and Burns (in press). Their study found that thoughts of death enhanced retention of subsequently processed items, suggesting that death may have something to do with the underlying mechanisms of survival processing. But, the current study seems to suggest that it may not be death that improves memory recall. Their results also suggested that in order for death thoughts to improve recall, there must be a cognitive component whereby participants think deeply or complexly about their own demise. It may be that the current study only invoked emotional responses to this awareness of death, and didn't really access the participants' conceptual awareness of death. It is possible that in order for the "death" manipulation to be effective, the participants must think that their OWN death may be in danger. The current study may have evoked thoughts of death, but not the participants thoughts of their own death. Thus, the previously suggested study using a dead human instead of a dead zebra might be a good way to get at that cognitive component. Another possibility for future study would be to manipulate the concern for a person's OWN death, purposely making one group aware of their own impending death and one group aware of death in general.

Hart and Burns' (in press) study, along with the findings of the current study, suggest that maybe it is just contemplating one's own death that plays a role in the survival processing memory benefit, and not general thoughts of death or thoughts of disgust associated with death. This could explain why there was no memory benefit, because "death and disgust" may not really get at one's awareness of their own death.

However, if this is the case, then in terms of the Soderstrom and McCabe study (2011), one would have to assume that the memory benefit that occurred for the zombie scenarios is due to the fact that the zombies makes one think about their own death more than they do for the other survival scenarios.

While this study implies that “death and disgust” thoughts are not one of the mechanisms involved in the typical survival processing memory benefit, further research must be done where the typical survival processing effect is replicated. Without this replication, no definite conclusions can be made. Nonetheless, the current findings provide a foundation for others to examine the possible mechanisms involved in the survival processing effect, and even more specifically the influence that death has on this memory benefit.

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Appendix A

CSW

INSTRUCTIONS: Please respond to each of the following statements by circling your answer using the scale from "1 = Strongly disagree" to "7 = Strongly agree." If you haven't experienced the situation described in a particular statement, please answer how you think you would feel if that situation occurred.

1	2	3	4	5	6	7
Strongly disagree	**Disagree**	**Disagree somewhat**	**Neutral**	**Agree somewhat**	**Agree**	**Strongly agree**

____ 1. I feel worthwhile when I perform better than others on a task or skill.

____ 2. Knowing that I am better than others on a task raises my self-esteem.

____ 3. My opinion about myself isn't tied to how well I do in school.

____ 4. Doing well in school gives me a sense of self-respect.

____ 5. Doing better than others gives me a sense of self-respect.

____ 6. I feel better about myself when I know I'm doing well academically.

____ 7. My self-worth is affected by how well I do when I am competing with others.

____ 8. My self-esteem is influenced by my academic performance.

____ 9. My self-worth is influenced by how well I do on competitive tasks.

____ 10. I feel bad about myself whenever my academic performance is lacking.

Appendix B

List of 48 Words (in the order they were presented)

1. Raincoat
2. Knob
3. Door
4. Trailer
5. Whip
6. Moss
7. ginger
8. garbage
9. patch
10. banker
11. oven
12. flood
13. bean
14. nail
15. skate
16. hamster
17. oboe
18. missile
19. wire
20. vinegar
21. zipper
22. doll
23. pimple
24. fork
25. iron
26. throat
27. purse
28. anchor
29. yolk
30. lint
31. envelope
32. basement
33. crumb
34. scissors
35. camel
36. headboard
37. jelly
38. vein
39. tunnel
40. mayor
41. brush
42. chalk
43. root
44. tobacco
45. seaweed
46. noodle
47. violet
48. toilet

Appendix C

PANAS Form

This scale consists of a number that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now, that is, at the present moment. Use the following scale to record your answers.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

__ interested	__ irritable
__ distressed	__ alert
__ excited	__ ashamed
__ upset	__ inspired
__ strong	__ nervous
__ guilty	__ determined
__ scared	__ attentive
__ hostile	__ jittery
__ enthusiastic	__ active
__ proud	__ afraid

Appendix D

Demographic Questionnaire

Are you a male or female (circle one): Male Female

The following questions are all concerned with the survival scenario you were given and the image that you created about the survival scenario. Please answer all questions by circling the appropriate number on the 10 point scale provided

How complex was the image you were asked to imagine:

1 2 3 4 5 6 7 8 9 10
simple complex

How vivid was the image you were asked to imagine:

1 2 3 4 5 6 7 8 9 10
dull extremely vivid

How gruesome was the image you were asked to imagine:

1 2 3 4 5 6 7 8 9 10
not gruesome extremely gruesome

To what extent did the scenario you were asked to imagine make you think about death?

1 2 3 4 5 6 7 8 9 10
a little a lot

To what extent did the scenario you were asked to imagine make you feel fearful?

1 2 3 4 5 6 7 8 9 10
not fearful extremely fearful

Please circle the number that best describes the way you would feel if you were actually in the present scenario:

1 2 3 4 5 6 7 8 9 10
happy sad

1 2 3 4 5 6 7 8 9 10
excited calm