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## The Effects of Stress on False Memory

Claire Van Vranken<sup>3</sup>

This study looks at the impact of stress on the creation of these false memories, using the Deese-Roediger-McDermott paradigm (DRM). A false memory is a memory of an event that never really occurred, but is believed that it occurred by the person remembering it. In a typical DRM study, participants are given a list of words that fall under the same category. When the participants are later asked to recall the words on the list, 40% of the participants recall a word that was not on the list with a high rate of confidence (Roediger & McDermott, 1995). Stress has been linked to the creation of false memories in previous studies. One such study revealed that stress can potentially increase the likelihood of false memory recollection; however another similar study reported stress did not affect the incidence of false memory but, that men were found to falsely recall more words than women. In the present study, half of the participants were given a stress inducing task, which consisted of standing up and completing mental math problems, whereas the other participants were asked to color for 5 min. Following these tasks, the participants were given a DRM task, on the computer. I hypothesized that participants that completed the stress-inducing task will be more likely to show false memory and that men will be more susceptible to the impact of stress on the formation of false memories.

False memories are memories of events that never really occurred, but the person that remembers the event strongly believes that the event was real. This study looks at the impact that stress has on the impact on the formation of false memories. One way of clinically inducing false memories is through the Deese-Rodiger-McDermott (DRM) paradigm. The first time that this phenomenon was observed was by James Deese in 1959. Deese (1959) gave participants in his study 36 lists of words, each list consisting of 12 words each falling under a specific category.

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The participants were then asked immediately to freely recall the words that they had just seen.

Free recall is when a person is asked to list off, in this case the words that they had just seen

without any prompts. It was found that 44% of the participants recalled seeing words that were

not on the list, but rather was the category of the overall list (Deese, 1959). This paradigm that

Deese discovered was not researched further until 1995 when Henry Roediger and Kathleen

McDermott confirmed Deese's findings. More research on the paradigm was done by Gallo,

Roberts, and Seamon (1997); they found that even when the subject knew that the researcher was

looking for false memories, the participant was still susceptible to falsely remembering the words

on the list they had seen. Even with the forewarning, the DRM paradigm was able to induce false

memories in the participants (Gallo, et al., 1997).

Similar studies to the present study have been conducted in the past with mixed results. A

study conducted by Payne, Nadel, Allen, Thomas, and Jacobs (2002) found a positive correlation

between stress and the increased formation of false memories. However, another study by

Smeets, Jelicic, and Merckelbach (2005) found no evidence of a correlation between stress and

the formation of false memories. However, they did find that men were more susceptible to the

DRM paradigm than women (Smeets, et. al, 2005). Yet another study conducted by Mohamed

(2011) also determined that there was no significant impact of stress on false memories. All three

studies used the Trier Social Stress Test. The Trier Social Stress Test uses elements of public speaking and mental math to induce stress in subjects.

The study of how stress can impact false memory is important for the use in eyewitness testimony, in court cases. A study conducted by Deffenbacher, Bornstein, Penrod and McGorty (2004) determined that the impact of stress on eyewitnesses negatively impacted the accuracy of the memory of the eyewitness. Currently, eyewitness testimony is used frequently in identifying suspects in criminal cases. Knowledge of how stress impacts these eyewitnesses' memories is profoundly important to more accurately represent what took place at the time of the event. Eyewitnesses at crime scenes and other traumatic events are going to be under stress, so understanding how stress impacts memories, specifically false memories can be helpful. As humans our memories are malleable and susceptible to suggestion, when this happens, that is a false memory, this frequently happens during interviews by the police following a crime or other stressful event.

The current study was conducted in a similar manner as the studies by Payne et al (2002) and Smeets et al. (2006). A version of the Trier Social Stress Test was used to induce stress in participants, although in this study a measure was taken following the induction of stress to ensure that the measure had been effective. Another variation from the previous studies is that in the current study a computer system was used to display the words in a consistent manner to the

participants. The current study was most similar to the Smeets et al. (2006) study as they also used math in their version of the Trier Social Stress Test.

## **Method**

### **Participants**

There were a total of 20 participants in the study. They were recruited through advertisement from the researcher, Sona Systems, and the Lindenwood Participant Pool. Compensation provided for participating in the study included extra credit from their corresponding professors, those that were not part of the Lindenwood Participant Pool, were given compensation in the form of chocolate.

The sample was made up of 6 men and 14 women. There were 5 freshmen, 4 sophomores, 3 juniors, and 8 seniors. The age range of participants was from 18 to 27 the mean age was 21.05. The number of participants had English as their first language was 11 and 5 stated that English was not their first language. There was a wide range of majors, 9 in total, they included psychology, biology, international relations, criminal justice, legal studies, finance, philosophy, studio art, and marketing.

### **Materials and Procedure**

Room Young 105 Skinner was used for conducting this study. In this room, a desk, chair, computer and writing utensil was provided so that the participant could comfortably sit and have

a place and writing utensil to answer the surveys. The room used was in Young Hall, and located in Lindenwood University, in the Psychology Research Labs.

The participants were asked to fill out two informed consent forms (see Appendix A).

One consent form was to be kept by the participants, and the other to be kept by the experimenter. Both parties were to fill out information including full name, signature, and date the study took place. The informed consent form is to ensure that the participants in the study was taking part in the study voluntarily, that they understood what taking part in the study required, and that in the event that they felt uncomfortable, they had the option of skipping a question or stopping participation in the study at any time. The participant was also made aware that any information or data obtained from their participation would be kept confidential, and that they were free to contact the researcher at any point in time. The informed consent form is only form that the participants placed their name on. Informed consent forms were kept separate and untraceable to any other data collected.

After filling out the informed consent form, participants were asked to complete a brief demographic survey (see Appendix B). The demographic survey was a self-report survey used to have the participant describe him or herself as accurately as possible questions created by the researcher. In this particular study, the participant was asked for gender, with the options of male, female, transgender, or other; age, where they must write how many years old they are;

current status in college, with the options of “freshman,” “sophomore,” “junior,” “senior,” or “not sure,” if English is their first language, with the options “yes” or “no,” and what the participants major was. Only the participant’s subject non-traceable ID number generated by the researcher was placed on this survey. No identifying information will be on the demographic survey.

Participants were randomly assigned to a group; they received a stress inducing measure or was put in the control group, who received no stress. The group of participants that received the stress inducing measure was asked to stand up and complete mental math problems until they completed all 14 problems (see Appendix C). The other group was given a coloring page (see Appendix D). Each participant that received the control measure was asked to color leisurely for 5 min with colored pencils that were provided for the participant.

Following the manipulation, each participant received a survey, The Positive and Negative Affect Schedule (PANAS) to assess their level of stress (see Appendix E) to determine if the stress inducing measure was effective. In the case of this study, the PANAS survey was used as it assesses current state of stress, whereas, the more commonly used PSS assess stress over the past two weeks. The survey asked about the participant's current state of stress. The survey included 20 questions, asking the participant to rank him or herself on a scale of 1 to 5, 1 being very slightly, 5 being extremely. The survey was scored by adding together items 1, 3, 5,

9, 10, 12, 14, 16, 17, and 19 to find the positive affect score. Following that score, items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20 were added together to obtain the negative affect score. In the case of this study, I was more interested in the negative affect score to ensure the stress measure was effective. The higher the positive affect number was the more stress the participant was under, the lowest possible negative affect score was 10 while the highest possible was 50.

Participants were given a list of words (see Appendix F) on the computer system ePrime, to memorize. Participants were then asked to freely recall (see Appendix G) words that they saw on the computer screen. Free recall is when participants are asked to remember items without cues to call on. They were then asked to recognize the words that they had originally seen on the ePrime system again. This second test of memory used recognition; this type of memory is when cues are used to trigger memories.

The feedback letter (see Appendix H) was given to participants at the end of the study to thank them for volunteering their time to participate in the study and debrief them on what the experiment was looking at. It was noted that individual results are not processed in this study, but rather, overall findings were of interest, and that it is not possible for the researcher to trace each participant's response on an individual basis. The letter reiterated that the participant is free to contact the researcher conducting the study at any time.



## Results

The hypothesis, those under the stress manipulation would be more susceptible to the DRM Paradigm than those under the control measure, was not supported. When all of the data was collected and an independent samples t-test was run,  $p = .226$  meaning no statistically significant correlation was found. The secondary hypothesis, men would be more susceptible to false memories through the DRM than women also proved to be incorrect. An independent samples t-test was run for this data set as well,  $p = .133$ , showing no statistical significant correlation. The only data that were found to be statistically significant was the negative affect score for those under the stress manipulation, an independent samples t-test was run and  $p = .049$ .

## Discussion

The results of this study were limited by the small sample size. Twenty participants was a rather small pool. It would also be better if there were a more even distribution of men and women. Potentially with a larger sample size and a more even distribution of men and women, the hypotheses within this study could hold true. In future studies, I would administer the PANAS survey before and after the control or stress manipulation to ensure that the stress manipulation was effective. As I was scoring the PANAS surveys I noticed that participants were bringing stress in with them. I think that it is vital to ensure that the stress measure is effective by

administering the PANAS survey twice. It also would be interesting to see how other stress manipulations, such as the cold pressor task would be at inducing stress, which would affect the DRM Paradigm more.

A follow up to this study would be to see how stress impacts eyewitness testimony, as this has a multitude of real world applications. Understanding how stress can impact false memory and memory formation in general can be vital to police investigations and other real world applications. False memory is an important subject to study, because the more we understand memory, the more we understand that it is malleable and imperfect.

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## Appendix A

## Informed Consent Form

I, \_\_\_\_\_ (print name), understand that I will be taking part in a research project that requires me to take a memory test after completing a task that may or may not induce a mild level of stress. I will also be completing questions assessing my stress level and answer basic demographic question on a survey. I understand that I should be able to complete this project within 30 minutes. I am aware that I am free to skip any questions in the unlikely event that I feel uncomfortable answering any of the items on any of the surveys or feel uncomfortable completing the stress task. I am also aware that my participation in this study is strictly voluntary and that I may choose to withdraw from the study at any time without any penalty or prejudice. I should not incur any penalty or prejudice because I cannot complete the study. I understand that the information obtained from my responses will be analyzed only as part of aggregate data and that all identifying information will be absent from the data in order to ensure anonymity. I am also aware that my responses will be kept confidential and that data obtained from this study will only be available for research and educational purposes. I understand that any questions I may have regarding this study shall be answered by the researcher(s) involved to my satisfaction. Finally, I verify that I am at least 18 years of age and am legally able to give consent or that I am under the age of 18 but have on file with the LPP

office, a completed parental consent form that allows me to give consent as a minor. I understand that I will be receiving extra credit through the LPP, if not recruited through the LPP, I understand that I will not receive extra credit.

\_\_\_\_\_ Date: \_\_\_\_\_

(Signature of participant)

\_\_\_\_\_ Date: \_\_\_\_\_

(Signature of researcher obtaining consent)

Student Researcher's Name and Number:

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Appendix B

**DEMOGRAPHIC QUESTIONNAIRE**

SUBJECT ID NUMBER: \_\_\_\_\_ (Assigned by Researcher)

1) What Gender do you identify with?

MALE          FEMALE          TRANSGENDER          OTHER

2) How old are you? \_\_\_\_\_

3) What year are you in school?

FRESHMAN          SOPHOMORE          JUNIOR          SENIOR          OTHER

4) Is English your first language?

YES          NO

5) What is your major? \_\_\_\_\_

### Appendix C

#### MENTAL MATH:

Participants will be given the math problems, verbally and asked to respond verbally.

$$2583 - 300 = 2283$$

$$2283 + 1200 = 3483$$

$$3483 - 90 = 3393$$

$$3393 - 800 = 2593$$

$$2593 + 85 = 2678$$

$$2678 - 650 = 2028$$

$$2028 - 600 = 1428$$

$$1428 + 1155 = 2583$$

$$2583 + 900 = 3483$$

$$3483 - 98 = 3385$$

$$3385 - 300 = 3085$$

$$3085 + 450 = 3535$$

$$3535 - 1500 = 2035$$

$$2035 + 548 = 2583$$

Appendix D





## Appendix E

### PANAS Questionnaire

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. Indicate to what extent you feel this way right now, that is, at the present moment.

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite A Bit	Extremely
_____ 1. Interested				_____ 11. Irritable
_____ 2. Distressed				_____ 12. Alert
_____ 3. Excited				_____ 13. Ashamed
_____ 4. Upset				_____ 14. Inspired
_____ 5. Strong				_____ 15. Nervous
_____ 6. Guilty				_____ 16. Determined

\_\_\_\_\_ 7. Scared

\_\_\_\_\_ 17. Attentive

\_\_\_\_\_ 8. Hostile

\_\_\_\_\_ 18. Jittery

\_\_\_\_\_ 9. Enthusiastic

\_\_\_\_\_ 19. Active

\_\_\_\_\_ 10. Proud

\_\_\_\_\_ 20. Afraid

## Appendix F

## Word Lists:

REST	SODA	CHILLY
BED	BITTER	HEAT
NAP	PIE	ICE
DOZE	HEART	HOT
TIRED	GOOD	SNOW
AWAKE	COCOA	FROST
SNORE	TOOTH	WET
PILLOW	SUGAR	ARCTIC
DREAM	HONEY	WARM
PEACE	TART	WINTER
DROWSY	CANDY	AIR
SNOOZE	TASTE	FREEZE
YAWN	NICE	WEATHER
BLANKET	SOUR	FRIGID
SLUMBER	CAKE	SHIVER
Sleep - Category Word	Sweet – Category Word	Cold – Category Word

Appendix G

FREE RECALL

Please list all words that you can recall seeing on the list displayed to you.

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
  
- 4. \_\_\_\_\_
- 5. \_\_\_\_\_
- 6. \_\_\_\_\_
  
- 7. \_\_\_\_\_
- 8. \_\_\_\_\_
- 9. \_\_\_\_\_
  
- 10. \_\_\_\_\_
- 11. \_\_\_\_\_
- 12. \_\_\_\_\_
  
- 13. \_\_\_\_\_
- 14. \_\_\_\_\_
- 15. \_\_\_\_\_
  
- 16. \_\_\_\_\_
- 17. \_\_\_\_\_
- 18. \_\_\_\_\_
  
- 19. \_\_\_\_\_
- 20. \_\_\_\_\_
- 21. \_\_\_\_\_
  
- 22. \_\_\_\_\_
- 23. \_\_\_\_\_
- 24. \_\_\_\_\_

25. \_\_\_\_\_ 26. \_\_\_\_\_ 27. \_\_\_\_\_
28. \_\_\_\_\_ 29. \_\_\_\_\_ 30. \_\_\_\_\_
31. \_\_\_\_\_ 32. \_\_\_\_\_ 33. \_\_\_\_\_
34. \_\_\_\_\_ 35. \_\_\_\_\_ 36. \_\_\_\_\_
37. \_\_\_\_\_ 38. \_\_\_\_\_ 39. \_\_\_\_\_
40. \_\_\_\_\_ 41. \_\_\_\_\_ 42. \_\_\_\_\_
43. \_\_\_\_\_ 44. \_\_\_\_\_ 45. \_\_\_\_\_

## Appendix H

### Feedback Letter

Thank you for participating in my study. The present study was conducted in order to determine whether an increase in stress increases the production of false memories. False memories are, memories of an event that never really occurred, but is believed, with a high degree of certainty, that it occurred by the person remembering it. In this experiment, false memory occurs when a person recalls a word that was not on the original list.

Please note that I am not interested in your individual results; rather, I am only interested in the overall findings based on aggregate data. No identifying information about you will be associated with any of the findings, nor will it be possible for us to trace your responses on an individual basis.

If you are interested in obtaining the final results of this study based on aggregate data, or if you have any questions or concerns regarding any portion of this study, please do not hesitate to let me know now or in the future. My contact information is found at the bottom of this letter.

Thank you again for your valuable contribution to this study.

Sincerely,

Claire Van Vranken

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