Effects of Stress on the Ability to Accurately Recall Details of an Event, and the
Formation of False Memories

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Abstract

This study will be examining the effect of stress on an individual’s ability to accurately recall details of a crime scene, as well as the formation of false memories. It is hypothesized that individuals who experience high stress immediately before witnessing a crime will not be able to recall as many details of the event as those whom experience little or no stress beforehand. It is also hypothesized that those who experience stress will also report more false memories. The findings of this study will not only help further enhance the knowledge of the effects of stress on false memories and the ability to recall details of a crime scene, but will also shed some light on the validity and accuracy of eye witness accounts during stressful situations.
False Memories

False memories are reconstructed memories about events that did not actually occur in reality. Often, these memories are formed without an individual actually knowing that they have been formed and never actually occurred (Solso, MacLin & MacLin, 2005; Conway, 1997). False memories are often associated with weak or vague images that are based on familiarity. They are initially developed either because of an inaccurate interpretation of an event and details surrounding it, or developed to fill in gaps in our memory over time (Conway, 1997). When looking at the development of false memories, most studies look at the effects of inducing stress and the occurrence of false memories. One study in particular by Payne, Nadel, Allen, Thomas and Jacobs (2002) looked at stress and its impact on the recollection of both related and non-related words. They found that more related words were reportedly recalled by the participants in the stress condition. These findings suggest that as stress increases, so does the likelihood of forming false memories. It also suggests that when forming false memories, we unknowingly choose memories that fill gaps in the most logical way, hence choosing related lure words over non-related lure words.

Unlike false memories where a false event or detail is recalled and thought to be true, “missing memories” are most understandably forgotten details of an event. These memories aren’t altered in anyway and don’t deviate from reality, they are simply unknown, and where either never actually formed into memories, or can no longer be recalled after a period of time. The effects of stress on the ability to recall the details of a situation or event vary greatly and are often conflicting. Some studies have found either no effects or interfering effects of stress on memory, while others suggest that more stress
yields higher levels of recall (Goodman, Hirschman, Hepps & Rudy, 1991). One study in particular that looks at forgetting memories was done by Lindberg, Jones, McComas, Collard & Stuart (2001). This study looked at young children and the effects of experiencing stress on forgetting as well as the ability to recall details of an event. In this study the children were divided into two groups. The first experimental group was given an inoculation, while the control group witnessed the other group receive the shots through a video monitor. The level of stress that the child experienced in both conditions was measured by the child’s subjective pain of the inoculation. The researchers found that the children who experienced the stressful event firsthand had more stressor related memories and a greater resistance to forgetting over time. They also found that the children who only witnessed the stressor had greater memories of non-stressor related details (e.g. color of the nurse’s shoes and shirt).

Since we know that false memories and forgetting are real events that are a part of every individual’s life, it is important to understand exactly why research in this area is important. While false memories and forgetting details typically do not negatively affect everyday life, they do have severe implications in the criminal and judicial world. The Innocence Project developed by Roots (2001) is a very startling example of how false memories and forgetting have severely affected the lives of many innocent civilians. The project itself was first developed to examine cold cases with new DNA testing. Because of this new type of testing, many cases that have been reviewed have shown that the wrong individual was convicted for the crime. So far the Innocence Project has exonerated 146 convicts, 13 of which were on death row. It is estimated that 15 of 70 cases had convicted an innocent person because of false witness testimony. While some
of these false witness testimony’s were individuals who purposefully lied on the stand, many of these false testimony’s were unintentional (Roots, 2001).

Because of the overwhelming evidence that false memories and forgetting are very common occurrences, it is important to further examine this subject because of its obvious implications. Not only does it suggest that our memories are not perfect, but it also suggests that eyewitness testimony, especially in the judicial system, should not be relied on for convictions. Also, the large variance in effects of stress on memory of certain events leaves the question of whether or not these false memories are more likely during stressful events or not. It is this aspect of false memories and stress that will be examined in this study. It is hypothesized that increased levels of stress will result in the greater number of formation and report of false memories. It is also hypothesized stress will also result in an increase in forgotten/missing details witnessed in a crime scene.

Method

Participants

The participants in this study consisted of 3 males and 10 females, all of whom were of good site and hearing. All participants were Caucasian and from a small Midwestern liberal arts college. They were recruited for the study on either a purely volunteer basis, or as an opportunity to obtain extra credit.

Equipment

Gateway Intel Pentium 4, model #E4300, computers were used in this study. The program was run on Windows XP, and displayed on fifteen inch diagonal screens. The program used to run the Dual Task Experiment was from the Cognitive Laboratory Experiments (CITE). The program was designed so that it would record the accuracy
levels of tracking a moving stimulus, and responses to secondary targets or non-target stimuli.

**Stimulus**

For the stress and no stress conditions of the experiment, both conditions utilized a small white dot of 4 pixels per update. In each trial the dot first appeared in the middle of the screen, and varied in movement at a 360 degree angle. Both conditions varied in speed of the dot, as well as size of the tracking box. The dot in the stressful condition traveled at a speed of 25 pixels per update, while the speed of the non-stressful condition traveled at 2 pixels per update. In the stressful condition the target box used to track the dot was 25 pixels per update, and in the non-stressful condition the box was 50 pixels per update. Like the dot, the box started each trial in the middle of the screen. The tracking box indicated participant accuracy by turning teal when the dot was inside, yellow when the dot hit the edge of the tracking box, and red when the dot was outside of the tracking box. In each condition no practice trials were given, and participants were also asked to respond to a secondary stimulus, a capital X presented among other non-target stimuli, while tracking the dot. A 1 minute and 4 second video clip of a crime scene was also used as a third stimulus. This clip portrayed a nighttime attack of a woman by a man who was attempting to assault and/or kill her, whom eventually runs away when he realizes he has been seen by a woman witness.

**Procedure**

Participants were first asked to complete and informed consent (Refer to Appendix A). Participants were then asked to complete either a stressful or non-stressful Dual Task experiment. They were instructed to use a computer mouse to track the
moving stimulus and responded to the target stimuli (X) by using the right click button. After completion of the dual task they were asked to immediately come over to another computer where they were shown the crime scene clip. Upon finishing the clip, participants were given a brief checklist format questionnaire to measure what details they could accurately recall seeing or hearing in the video (See Appendix B). Finally, they were given a debriefing and told that they had just completed either a stressful or non-stressful task, followed by a memory task (See Appendix C). The questionnaires were then compiled and scored against a pre-made answer key. Any response that was not an option on the answer key was marked as a false memory. Anytime a response was not marked that should have been, it was deemed a missing memory. Each false memory and missing memory was then tallied per participant for further analysis.

Results

An independent t-test was run on the number of occurrences of false memories and stress vs. no stress. The stress group had a mean score of \( M = 5.71 \), while the no stress group had a mean score of \( M = 6.00 \). The difference in scores between these two groups was not significant at \( t(11) = -0.21, p = 0.84 \).

A second independent t-test was also run on the number of occurrences of missing memories and stress vs. no stress. The mean score of the stress group was \( M = 12.00 \), and the mean score of the no stress group was \( M = 10.50 \). Like false memories, the difference in scores between the number of missing memories and whether or not stress was present was not significant at \( t(11) = 11.04, p = 0.32 \).

Discussion
While the results of this study show that there is no significant difference in the number of false and missing memories in regards to levels of stress, these results do not disprove the theory that false memories and forgetting do exist. When reviewing the questionnaires individually there is even some evidence that false memories are formed as a means of filling in missing information in a consistent and logical manner. For example, in the beginning of the post-video questionnaire, one of the participants indicated that they had seen a wallet at some point in the video. Later when asked what the crime was, they said that it was an assault and mugging. Although assault was the correct answer, they also thought it was a mugging to explain the false memory of “seeing” a wallet (Conway, 1997). Regardless of whether or not stress really does or doesn’t play a role in the development of false memories, it is clear that our memories are not perfect. Because of these imperfections it is crucial that convictions are not made on eyewitness testimony alone. Also, the large variance in effects of stress on memory of certain events leaves the question of whether or not these false memories are more likely during stressful events or not.

This study in particular had several limitations that may have resulted in our lack of significant findings. The first major limitation is the use of the dual task as a stressor. Because no measure of anxiety was given, it is unclear whether or not the dual task was actually subjectively perceived as a stressor to the individual. It is also possible that because the dual task was novel to all participants, maybe both conditions were in actuality a stressor. This could explain the lack of significant difference between the two conditions. Another possible limitation of this study was using a checklist questionnaire format. Because many of the questions had multiple answers and lots of choices, its very
possible that some of the options were missed due to skimming, or the questionnaire being overwhelming in itself. For future studies it is suggested that the questionnaire be revised and possibly worded in a yes/no format. It also may be interesting to focus more on memory decay and measure this by varying the time elapsed between watching the video and completing the questionnaire. It is also recommended that a video of better quality be used for future studies to prevent measuring interpretation rather than false memory. Because our video was grainy and dark, even the coders had a difficult time creating an answer key (i.e. whether the perpetrator was wearing a white or light pink shirt was debated).

Overall, this study shows that false memories and forgotten or “missing” memories do exist. It also demonstrates the need for further examination of the affects of stress on each of these aspects. Further knowledge in this field is pertinent not only to the scientific community, but also in determining the reliability of eyewitness testimony in the criminal justice system.
References


Appendices A

Informed Consent

This experiment is examining how prior tasks affect perceptions. You will be asked to complete a task, then watch a video and answer questions about the video. There should be no risk of physical harm, psychological harm, or extreme stress. All results and participant names are strictly confidential, and participation is voluntary. If you wish to withdraw from the study at any time, you may do so without penalty.

Thank you for your time and attention
Russalyn Spicer, Ashley Recker, and Sarah Vogt

Hanover College

I agree to participate in this study on how prior tasks affect perception. I understand that all results and names are strictly confidential, and I understand that I may withdraw from the study at any time without penalty.

_______________________ _______________________
Participant Name Date
This experiment was designed to study the effects of prior tasks (either stressful or not stressful) on the memory of an event. The task you completed was either easy or difficult, but the video clip was the same for all participants. We will examine the effects of difficulty of the tasks on your responses to the questionnaire given to you after the video clip. We expect to find that participants with the stressful task before viewing the video will have more false memories, or recall more events that did not actually happen in the video, than participants who completed the less stressful task. This research is important in studying eyewitness testimonies and the likelihood of false memories in them. If more stressful events produce more false memories, legal officials may need to take this into account in regards to eyewitness accounts of events. We did not fully disclose the purpose of the experiment because we did not want the purpose to affect your results for the study.

If you have any questions, please feel free to contact:
Russalyn Spicer (spicerr@hanover.edu)
Sarah Vogt (vogts@hanover.edu)
Ashley Recker (reckera@hanover.edu)

This study was completed under the direction of John Krantz (krantzj@hanover.edu). Feel free to contact him with any questions or concerns.

You may find the results of this study, when completed, by contacting one of the researchers listed above.

Thank you again for your participation in this study.
Appendices C

Post-Video Questionnaire and Answer Key (Answers are Bolded)

Within this questionnaire, please take the perspective of the female observer. Please take your time, read all available options, and answer each question to the best of your ability.

1. Check all that you remember seeing (Check all that apply.):
   wallet 
   underwear
   purse 
   watch  
   car
   hedges
   robe
   lamp post
   police officer
   blood

2. What did you hear within the crime? (Check all that apply.)
   gunshot
   screams
   police sirens
   arguing
   man shouting
   If so, what did he shout? _____________________________________________
   woman shouting
   If so, what did she shout? ____________________________________________

3. What was used in the crime?
   knife
   gun
   baseball bat
   sledge hammer
   fists
   hands

4. Where did the crime take place? (Check all that apply.)
   Park
   Backyard
   Driveway
   Parking Lot
   Bedroom
   Inside
   Outside
   Living Room
   Garage
   City Street

5. When did the crime take place? (Check all that apply.)
   4:00 am
   7:42 am
   8:00 am
   2:00 pm
   midnight
   at night
   in the morning
   during the day

6. What was the crime?
   rape
   mugging
   assault
   murder
   attempted murder
   domestic dispute
7. What do you remember about the perpetrator's appearance? (Check all that apply.)

- **man**
  - brown hair
- woman
  - **short hair**
- **blue jeans**
  - long hair
- khaki pants
  - curly hair
- gray skirt
  - **straight hair**
- black skirt
  - gray jacket
- white skirt
  - **brown jacket**
- **pink shirt**
  - heavy-set
- red shirt
  - skinny
- blue eyes
  - dress shoes
- brown eyes
  - tennis shoes
- **blond hair**

8. What do you remember about the victim's appearance? (Check all that apply.)

- **man**
  - brown hair
- **woman**
  - short hair
- blue jeans
  - long hair
- khaki pants
  - curly hair
- gray skirt
  - straight hair
- **black skirt**
  - gray jacket
- **white shirt**
  - brown jacket
- **pink shirt**
  - heavy-set
- red shirt
  - skinny
- blue eyes
  - dress shoes
- brown eyes
  - tennis shoes
- blonde hair

9. Was the perpetrator caught in the end of the scene?

- yes
  - If so, please explain how he was caught.
    
- no
  - If so, please explain why he was not caught.
    
Either one, depending on explanation.