The Incidence of False Confessions Under High Cognitive Load

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Abstract

The present study assesses circumstances under which an individual may be vulnerable to false confessions. By understanding how false confessions occur, researchers can enable interrogators to obtain more reliable information. The purpose of this research is to explore the possibility of physiological responses, particularly electrical activity in the prefrontal cortex, as an indicator of when someone is falsely confessing or lying. Also, the research studies how cognitive fatigue, which is reduced decision-making capacity during times of high mental demand, can affect a person's memory in interrogation settings. In this study, participants were given two lists of words that have been proven to elicit false memories (Underwood, 1965), and then they were instructed to cross out any words that appeared on both lists. In the presence of a light that was a cue to respond truthfully, the subjects were asked about words they had seen on the two word lists earlier and were instructed to verbally recall from memory if they had or had not crossed out the words earlier. In this research, a false confession was defined as a subject stating that he or she had crossed out a word not crossed out earlier. Given prior research on cognitive load, it is anticipated that greater cortical activation, especially in the prefrontal cortex, will occur for untruthful responses during false confessions. An analysis of variance was conducted on the data collected through electroencephalography, but no significance was found, likely due to low statistical power. If there had been a real effect in the data, the high degree of variance that was present prevented it from showing. A Pearson correlation was conducted on the multiple choice and recall scores of the subjects, and a correlation was found between a subject's memory and the rates of false confessions and lies. A statistical significance was found between a subject's memory and the rate of false confessions. This finding supports the hypothesis that, under conditions of higher cognitive load, an individual may be more susceptible to false confessions. Applications to interrogation techniques and the Innocence Project will be discussed.

Introduction

In the legal system, a suspect's confession is a prosecutor's strongest weapon against the defense. However, the credibility of confessions is controversial due to the chance that a suspect may have falsely confessed. One of the most counterintuitive ideas in life is the proposition that an individual might falsely confess to doing something he or she has not done, especially in the context of the criminal justice system, which jeopardizes life and liberty of the accused. Since the emergence of the Innocence Project in 1992, 349 individuals have been exonerated, with DNA evidence confirming that 25% of them had falsely confessed (Innocence Project, 2017). False confessions can be internalized by individuals, leading them to believe they have done something they have not. Internalized false confessions occur due to an individual's memory being manipulated (Kassin, 2008, pp. 249-251). The pressure a subject is exposed to during an interrogation can render the suspect's memory vulnerable to these manipulations. The purpose of the present study is an empirical investigation of electroactivity in the brain during a switch in executive functioning as well as the impact that truthfulness and deceptiveness have on the accuracy of memory. A small sample size compromised the statistical power of the study and created a high degree of variance, which prevented any real effect in the data from being shown. However, the research did find that subjects who were induced to make false confessions and subjects who were induced to lie had a statistically significant higher degree of inaccuracy in their memory, whereas subjects who were more truthful had a statistically significant higher degree of accuracy in their memory.

Interrogations can last for many hours and put great stress on the individual to recall past activities. Psychological research has found that, when an individual experiences an increase in cognitive load, short term memory (STM) recall will be less accurate. The more demanding a task, the less recall an individual will have. According to Barrouillet, Bernardin, and Camos (2004), if a cognitive load is kept constant, then an individual's recall performance should remain unchanged. Additionally, this study presented a time-based resource-sharing model. The model assumes that an individual's memory is dependent on attention and that, as soon as attention is turned away, memory begins to decay (Barrouillet et al., 2004). A separate study discovered that longer retention times led to decreased performance, a widely understood phenomenon referred to as cognitive load (Ricker, Vergauwe, Hinrichs, Blume & Cowan, 2015). When the results of these two psychological studies are considered together, the assumption arises that, when a task is difficult and an individual has to retain information for a longer time before recalling it, both the rates of recall and the accuracy of recall will be decreased. This assumption helps to explain why someone may falsely confess in an interrogation, which often will last for an extended period of time and cause cognitive fatigue. Not only do cognitive load and retention time affect the ability to recall, but associative factors have also been found to affect recall ability.

In a replication study by Roediger and McDermott (1995), a list of words that were associated with another word, or "paired associate learning," was used and proved to be a powerful technique to elicit and study false memories. This research contributed to the present study a pre-established word list that has been empirically studied and proven to elicit false memories (Roediger & McDermott, 1995).

A reliable and accurate means of detecting lies and truth in the justice system is needed because the United States leaves verdicts to be decided by a jury. However, behavioral and social research has proven that humans are good at lying and poor at judging when a person is lying (Vrij, 2014). The most common means of lie detection used today is the polygraph. The polygraph records the physiological activity of arousal in an individual's autonomic nervous system (ANS). Research laboratories at the University of Minnesota report that empirical evidence from studies involving polygraph tests and mock crimes have found the accuracy of polygraphs in detecting deception to be from 70% to 85% (Lykken, 1974, p. 30). However, both children and those with a diminished IQ are more likely to falsely confess, and likewise the accuracy of a polygraph decreases when used with the more vulnerable populations (Gudjonsson, 2010, pp. 166-168).

Technology advance today has shifted the focus of lie detection from ANS response to brain imaging. Recently, functional magnetic resonance imaging (fMRI) of the brain has been studied in attempt to differentiate deception and lying from truth-telling (Langleben & Moriarty, 2013). At the Medical University of South Carolina's Center for Advanced Imaging Research, a fMRI study on the neural correlates of deception revealed that, when an individual is lying, his or her brain activity increases (Kozel, Padgett & George, 2004). A second fMRI research project focused on the Machiavellian personality type, a term for those who commonly use deception and manipulation to cheat and "outsmart" others (Verbeke et al., 2001). The results from this second study displayed significantly higher activity in the prefrontal cortex in those who are lying (Verbeke et al., 2011).

An original study by Daryl Bem (1966) entailed inducing false confessions and aimed to prove that a false confession can distort recall of past behavior if the confession is given with the association of cues that are indicative of the individual telling the truth. Results from Bem's research showed that false confessions in the presence of the truth cue will produce more errors of recall than false confessions given in the presence of the lie cue or no confession at all; true confessions that were given in the presence of the lie cue were found to have produced errors of recall (Bem 1966, pp. 709-710). A replication of Bem's research was later performed by Christina Maslach (1971). As a replication study, it was expected to result in findings similar to and reflective of those of Bem. However, Maslach's replication did not support Bem's findings, which has led to controversy in the field (Maslach, 1971).

With controversy in the field of psychology regarding false confessions, this research project was an attempt to support Bem's findings through a replication of his experiment. Contrary to conventional polygraph methods, which utilize galvanic skin resistance as a means to detect deception, this study used electroencephalography (EEG) in an attempt to distinguish between truth and deception. Emphasis was placed on the electrical activity in the prefrontal cortex. Subjects were exposed to tasks that taxed their cognitive load and caused cognitive fatigue. Measurements were taken of the subject's ability to accurately recognize or recall as a means of gauging how cognitive fatigue affects memory. It was anticipated that, during the baseline assessment, there would be a significantly higher frequency shift in the frontal lobe when someone was falsely confessing or lying than when he or she told the truth. Secondly, the researchers anticipated that, during the assessment of the measured variable, there would be a significantly higher frequency shift in the frontal lobe when someone was falsely confessing or lying than when he or she was telling the truth. Lastly, the researchers anticipated a main effect on learning, such that the participant presented false confessions while believing he or she was telling the truth.

Method

Participants

Participants were solicited from various undergraduate psychology classes at Methodist University and recruited on a volunteer basis. The participants in the research experiment were 18 years or older, came from various demographical backgrounds, and included both males and females.[1] All participants had hairstyles that allowed the electrodes on the EEG cap to reach their scalp to collect usable data. Participants in the research experiment who were currently enrolled in a psychology class at Methodist University received extra credit for their participation, and every participant received a $15 gift receipt to the Methodist University Bookstore upon completing the experiment.

Materials

An informed consent (see Appendix A) was completed by each participant, and a form for extra credit was completed if applicable (see Appendix B). Before going through the experiment, each participant was also given a self-questionnaire to complete (see Appendix C). The EEG cap, used to measure the physiological reactions of participants, was hooked up to a computer, and the reactions were measured using Lab Scribe software. Electro Gel was applied with a gel applicator inside the sensors of the EEG cap, and two foam circles were placed on the forehead, which allowed the sensors to record the participant's brainwaves. In order to properly place the EEG cap on an individual's head, measuring tape and a marker were used to determine the precise alignment of the foam circles. A word list of 90 words (see Appendix D) and a separate word list of 45 words (see appendix E) were given to the participant to later recall. The words from both lists were randomly selected from lists of words pre-established by Roediger and McDermott (1995) and empirically proven by them to elicit false memories. The word list was intended not only to induce false confessions from the participant but also, due to the level of difficulty and focus required, to cause the participant to suffer cognitive fatigue resulting in memory decay. While the participant was being questioned, a red or a green light was lit according to the condition the individual was assigned to and the question asked. One of two different types of word tasks, either multiple choice (see Appendix F) or free recall (see Appendix G), was used in the last part of the experiment to record which words the participant could recall from earlier. The multiple-choice test was created by the researchers using the same words that had been randomly selected from the word lists of Roediger & McDermott (1995).

Design and Procedure

The experimenter went over the informed consent with each participant so that all participants would be aware of the risks involved with the experiment and of their right to withdraw at any time during the experiment. The participants were randomly split between Condition A, Condition B, Condition C, and Condition D. In Condition A and

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[1] The researchers did not collect demographic information for analysis because the subject pool was limited in size and diversity while the investigative procedures and data analysis measures were time-consuming. Therefore, due to time constraints, analysis of subject demographics was not pursued.

Condition B, the participant was instructed to give a true response when the light was green and an untrue response when the light was red. However, those assigned to Condition A received a multiple-choice test at the end of the experiment, whereas those assigned to Condition B received a free-recall test at the end of the experiment. In Condition C and Condition D, the participant was instructed to give a true response when the light was red and an untrue response when the light was green. Those participants assigned to Condition C received a free-recall task at the end of the experiment, whereas participants assigned to Condition D received a multiple-choice test at the end of the experiment.

After the participants signed the informed consent and any applicable extra credit form, they were given one word list of 90 words and another list of 45 words, and were instructed to cross out any words on the 90-word list that were also on the 44-word list. They were not given a time limit to complete this task. Once they finished crossing out the duplicated words, they were given a 20-item self-questionnaire created by the researchers, which was intended to divert the participants' attention from the word task they had previously completed and enable researchers to gather a physiological baseline assessment of each participant when telling a lie and when telling the truth.

After the self-questionnaire, one of the researchers measured the head circumference and the distance from middle of the forehead to base of the head to find and mark the halfway point between nasion (middle point of the nasofrontal suture) and inion (the external occipital protuberance of the skull). The number of the circumference was changed by placing a decimal between the two numerals and dividing the new number by two. The resulting number set the distance of marks to the right and left of the mid-forehead mark, and on those two marks the foam circles were placed. The placement of the EEG equipment followed the ordinance of the 10/20 method (Trans Cranial Technologies, 2012, pp. 1-2). Having completed the measurements, the researcher placed the EEG strap and cap on the participant, and instructed the participant to be as still as possible while wearing the EEG equipment.

One researcher informed the participant of the rules for the green and red lights, and how the participant should answer depending on his or her assigned condition. That same researcher began to ask the participant for his or her answers on the self-questionnaire by asking for true or untrue responses depending on the color of the light, red or green. At the same time, the second researcher marked each question on the computer software collecting the EEG data. After collection of the baseline data, the first researcher asked the participant whether he or she had crossed out words from the word list presented earlier, and the second researcher continued to mark the questions on the EEG software. During these questions in Condition A and Condition B, the green light was on to show that the participant was to answer truthfully. In Conditions C and D, the red light was on to indicate the participant was to answer truthfully. Lastly, the EEG equipment was removed, and the participant was given either a multiple-choice word task or a word-recall task; there was no time limit for these tasks.

The experimenter debriefed each participant about the subject of the experiment. For completing the experiment, each participant received a $15 gift receipt to spend at the Methodist University Bookstore. After the participant left, one of the researchers scored how many false confessions, lies, and truths the participant gave when asked about the words he or she had crossed out. In this research, a false confession was operationally defined as a participant claiming to have previously crossed out a word that he or she had not crossed out, and a lie was operationally defined as a participant claiming *not* to have crossed out a word actually crossed out earlier. A truth was operationally defined as a participant accurately reporting that he or she did cross out a word in fact crossed out earlier or saying that he or she had not crossed out a word actually not crossed out earlier.

Results

After analyzing the baseline EEG data, the researchers determined the mean frequency shift for each subject during truthful answers and the mean frequency shift during lies/false confessions. The researchers then scored the subjects' word-recall tests and the multiple-choice tests. For every true or false answer, the researchers determined the mean frequency and then calculated the difference between that frequency and the baseline true or false frequency. This was repeated for each subject in all conditions. An analysis of variance (ANOVA) was conducted on the data collected through EEG, but there was no significance found. The confidence interval for the EEG data analysis was True (-1.3618, 2.5636) and False (-1.2734, 2.6520). See Table 1.

Table 1. Confidence Interval (95%) on EEG Analysis

				95% confidence	interval
Factor	n	m	SD	lower	upper
True	10	0.6009	2.8297	-1.3618	2.5636
False	10	0.6893	3.0737	-1.2734	2.6520

Pooled StDev = 2.95419
n=number of subjects
m=Mean
SD= Standard Deviation

Upon further analysis of the data, a Pearson correlation was conducted on the multiple-choice and recall scores of the subjects, and a correlation was found between a subject's memory and the rates of false confessions and lies. A statistical significance was found between a subject's memory and the rate of false confessions, such that, when more lies and false confessions occurred, the subject's multiple-choice and recall scores decreased and, as the number of truths increased, the multiple-choice and free-recall scores increased. This finding is supportive of the hypothesis that under conditions of higher cognitive load an individual may be more susceptible to false confession.

Subjects responded to 48 questions, and a few significant results were found as anticipated (n=24). Subjects who falsely confessed during the experiment had significantly lower multiple-choice scores (r=-0.709, p=0.0099) or significantly lower free recall scores (r=-0.649, p=0.0225). As a built-in design replication, there was also significance found between truthful responses and higher multiple-choice scores (r=0.7116, p= 0.0094) or higher free recall scores (r=0.789, p= 0.002). See Table 2.

Table 2. Multiple-Choice and Recall Task Scores

	Multiple Choice		Free Recall	
	r	p-value	r	p-value
False Confessions	-0.709	0.0099**	-0.649	0.0255*
Lies	-0.501	0.0974	-0.569	0.0535
Truth	0.712	0.0094**	0.789	0.0023**

r= correlation coefficient
*p < .05
**p < .01

Discussion

Data for the EEG portion of the experiment was collected from a total of 24 subjects. Upon analysis of the data, it was determined that the data from four of the subjects needed to be eliminated from the study due to the equipment being faulty and not recording any data (administrator error).

It is believed that the EEG results did not come out as anticipated due to the small number of subjects—only 20, ultimately—and time constraints, which created little statistical power and a high degree of variability in the data. Additionally, even if there were a real effect in the data, the high degree of variance would prevent it from being shown.

Partial support for the hypothesis was found. Although there was no significance in the EEG data, significant findings were observed that provide strong support for the cognitive load hypothesis. Results from the research showed that, as the number of false confessions increased, multiple-choice and recall scores decreased. As the number of lies increased, multiple-choice and recall scores decreased. As the number of truths told throughout the study increased, the scores on the multiple-choice and recall tests increased. This suggests that the poorer one's memory, the more likely one will falsely confess and the better one's memory, the more likely one will tell the truth. Furthermore, the better one's results on the recall or multiple-choice task, the less likely one is to falsely confess. This strong correlation between truthful responses and higher scores on the multiple-choice and free-recall tasks reinforces the current theory that truthful behavior requires a lower cognitive load and is therefore easier to remember.

The purpose of this study was to conduct a replication the research by Bem (1966) and Maslach (1971) and to confirm one of the differing results. Bem (1966) demonstrated in his research that the effect of a truth cue was to elicit more false confessions, whereas Maslach (1971) contended that subjects were more accurate in recall regardless of light conditions. The present research assumed that an increase in cognitive load would generate more false confessions; however, the data supported the conclusions of Maslach (1971) and refuted the earlier claim by Bem (1966). Future research should include the use of galvanized skin response in conjunction with the collection of EEG data. This may assist future researchers in determining if subjects are willfully being dishonest or if they are genuinely unsure of the given response. Additionally, future researchers should focus primarily on the difference between true and false confessions and not include the operational definition of internalized confessions. This strategy may give researchers a better understanding of the basic processes before they focus on the more complex issue of false internalized confessions, i.e., false statements that a subject may believe to be true.

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Appendix A

Physiological Effects of Confessions

1. **Purpose**: The research's purpose is to study different physiological effects of confessions
2. **Procedure**: You'll be presented with a word task complete along with a self-information questionnaire. You will have physio equipment applied to you, and then you will be asked questions from your self-information form and be instructed to respond by lying or by telling the truth. Next, you will be asked about particular words you may have seen earlier. You are to say if you did or did not cross out each word you are asked about. Your answer must be in a complete sentence. Lastly, you will be given an assessment test to see how well you're able to remember the words from the word task from the beginning of the experiment.
3. **Anonymity of Participants and Confidentiality**: The information you will share with us, if you participate in this study, will be kept completely confidential and anonymous.
4. **Discomfort and Risks**: There are no risks associated with this research. This research will include the placement of a chest strap to hold the EEG cap in place. A female researcher will be utilized for the placement of the chest strap on female participants. Male participants will have either a female researcher or a male researcher place their chest strap according to the level of the participant's comfort. An EEG cap will be worn on the head and a gel will be placed on the sensors using an applicator. You may feel some slight pressure on your scalp during the application of the gel; however, it will not be painful. If you experience any discomforts, please let the researcher know.
5. **Benefits of the Study**: Your participation will help to advance knowledge in understanding the physiological effects confessions. You may also receive extra credit in one of your classes and monetary compensation.
6. **Freedom to Withdraw**: You are free to withdraw your participation at any time without penalty. You may also skip any part of the study at no penalty.
7. **Approval of Research**: This research is approved as a class project under the supervision of Dr. Snyder. If you have any questions, feel free to contact us:

Katherine Snyder, Ph. D. — Ksnyder@methodist.edu
Taylor Porter — tporter@student.methodist.edu
David McNeil — dmcneil@student.methodist.edu

By signing below, you freely consent to participate in this physiological study of confessions.

________________________ __________________________ ________
Subject's Name   Signature   Date

Appendix B

Extra Credit Information

____

Course

____

Course Professor

Appendix C

Self-Questionnaire/Information Sheet

1. How old are you?
2. What is your gender?
3. What is your class classification?
4. What is your major?
5. What is your favorite color?
6. Are you a commuter student or a residential student?
7. Do you work?
8. How many siblings do you have?
9. What color are your eyes?
10. Do you have any tattoos?
11. How many languages do you speak fluently?
12. Do you smoke?
13. What month were you born?
14. What city are you from?
15. What type of food do you not like?
16. What is your favorite TV show?
17. Do you have any allergies?
18. What is your favorite season?
19. What is your favorite drink?
20. What size shoe do you wear?

Appendix D

Word List

Woman
White
Daughter
Fast
Sandwich
Injection
Shoe
Valley
Mad
Low
Mississippi
Table
Bumpy
Bed
Crust
Vegetable
Web
Hot
Boat
Jazz
Lawyer
Speed
Chocolate
Banana
Queen
Blue
Steal
Hard
Orchestra
Radio
Smooth
Curtain

Enrage
Tired
Surgeon
Pillow
Ice
Orange
Husband
Slice
Aunt
England
Toe
Thread
Niece
Rugged
Uncle
Emotion
Climb
Up
Swim
Awake
Dark
Quick
Legs
Crown
Bug
Mouth
Sky
Summit
Freeze
Knitting
Criminal
Dentist

Doze
Cake
Rubber
Brown
Tarantula
Physician
Screen
Delay
Toast
Cotton
Tall
Insect
Temper
Peak
Air
Gravel
Seat
Throne
Crook
Sister
Symphony
Fluffy
Wood
Shutter
Father
Sugar
Bridge
Syringe
Honey
Frame
Knee
Kiwi

Appendix E

Alphabet List

Criminal	Peak	Ice
Table	Crown	Shoe
Lawyer	Husband	Chocolate
Speed	Crust	Legs
Cake	Symphony	Vegetable
Curtain	Gravel	Fluffy
Mad	Toast	Brown
Pillow	Tired	Jazz
Blue	Queen	Air
Frame	Uncle	Knee
Bed	Bridge	Physician
Knitting	Sky	Temper
Up	Injection	Web
Rugged	Fast	Daughter
Orange	Bug	Steal
Boat	Valley	Sister

Appendix F

Directions: Circle the words you crossed out earlier in the word task.

1. A. Anger
   B. Temper
   C. Enrage
   D. Emotion

2. A. Dark
   B. White
   C. Blue
   D. Black

3. A. Bread
   B. Sandwich
   C. Slice
   D. Toast

4. A. Wood
   B. Table
   C. Seat
   D. Chair

5. A. Freeze
   B. Cold
   C. Hot
   D. Ice

6. A. Lawyer
   B. Dentist
   C. Doctor
   D. Surgeon

7. A. Foot
   B. Shoe
   C. Mouth
   D. Toe

8. A. Banana
   B. Kiwi
   C. Vegetable
   D. Fruit

9. A. Girl
   B. Niece
   C. Sister
   D. Aunt

10. A. Up
    B. Low
    C. High
    D. Tall

11. A. King
    B. Queen
    C. Throne
    D. England

12. A. Woman
    B. Father
    C. Husband
    D. Man

13. A. Valley
    B. Mountain
    C. Summit
    D. Climb

14. A. Music
    B. Radio
    C. Jazz
    D. Orchestra

15. A. Thread
    B. Syringe
    C. Needle
    D. Knitting

16. A. Mississippi
    B. River
    C. Boat
    D. Swim

17. A. Rugged
    B. Smooth
    C. Bumpy
    D. Rough

18. A. Sleep
    B. Doze
    C. Tired
    D. Awake

19. A. Quick
    B. Slow
    C. Delay
    D. Fast

20. A. Pillow
    B. Hard
    C. Soft
    D. Cotton

21. A. Web
    B. Tarantula
    C. Insect
    D. Spider

22. A. Sweet
    B. Sugar
    C. Chocolate
    D. Honey

23. A. Crook
    B. Thief
    C. Robber
    D. Criminal

24. A. Curtain
    B. Screen
    C. Window
    D. Shutter

Appendix G

Directions: To the Best of Your Ability, Recall and Write down the Words you crossed out in the Word Task Earlier.