Investigating The Creation Of False Memory In Participants When Controlling For Stress

Levels And Quality Of Sleep.

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March 2020

National College of Ireland   2020

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Acknowledgements

Firstly, I would like to express my utmost gratitude to my research supervisor, Dr Michelle Kelly, who was incredibly supportive and helpful throughout this entire process. Without your encouragement, expertise and patience this would not have been possible. Also to Michael Cleary-Gaffney, for providing essential tools relating to collecting data and on data analysis.

I would like to extend my thanks to the psychology department of NCI, to my teachers and lecturers who showcased support and interest throughout this course. And to the staff in the library department who provided essential resources and research materials. Also I would like to give a general thank you to all the anonymous participants who took part in my study. Everyone who took part made this research possible.

Lastly, I would like to thank my family and friends who were so patient, understanding and supportive to me during the course of this dissertation, to my close friends who gave me exceptional advice and words of encouragement to me during this time. To my family and relatives who showed interest and engagement during the research process.

I want to give special thanks to my mum, Carol who was extremely encouraging and reassuring throughout these past months, and to my dad Alan who helped me with staying on track and motivated throughout the course of this project.

Abstract

This paper explores the relationship between stress levels, sleep quality and false memory performance in participants. There were a total of 109 participants, 54 females, 38 males and 17 participants' genders were unaccounted for. The majority of participants were recruited through means of social media. A survey was made using Google Forms and iMovie, consisting of the Perceived Stress Scale, The Single Item Sleep Scale and the DRM Paradigm. 5 Word lists were used as were 5 false memory words. A multiple regression was conducted to test the relationship between stress and sleep (predicitor variable) and false memory (criterion variable). It was found that sleep did not have a significant effect on false memory however stress was statistically significant. This indicates that false memory was impacted by participants stress levels. A Mann Whitney U Test was conducted to test the relationship between false memory and differences in gender.

It was found that males were more susceptible to false memory as opposed to females, whose scores indicated lower false memory performance (a score of 5 means no false memory, 15 means all five false memory words were chosen). Overall, this study concludes that false memory was affected by stress levels and gender. There were limitations to this study, there was a limited time frame, thus impeding on the sample size. These findings are of both similar and contrasting results to previous research, leaving opportunity for additional research in the area of false memory.

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Introduction

This study is investigating the relationship between stress, sleep quality in participants and false memory performance. There is a considerable amount of research conducted regarding the variables individually and in pairs, however there is little available research comparing the three variables in the format of a false memory test. In order to understand the combined relationship as best as possible, the prior literature and research conducted must be considered

Early experiments in memory research were seen by Ebbinghaus, 1885. Experiments were mainly experimental in design and were focused on memory recall or recognition. Experiments would measure the speed and accuracy of recollection, what parts of the brain were used and computational models were formed. Ebbinghaus was the first to investigate forgetting, and experiments consisted of nonsense syllables, and thus created the forgetting curve. Calkins, 1894 researched recency and memory. In the early years of experimental psychology, Calkins early studies often refer of primacy, recency, frequency, and vividness as well as an introduction to the paired associates method (Cofer, 1979; Newman, 1987; Postman, 1985, Madigan, S., & O'Hara, R. 1992). During this period, behaviourism was prevalent in psychology research, and there was a main focus on emphasised learning rather than memory, until the cognitive revolution during the 1960s. Waugh and Norman, 1965 further developed the dual store model which had been originally proposed by William James in 1890, (focused mainly on primary and secondary memory). Atkinson and Shiffrin then invented the multi store model of memory in 1968, (Atkinson and Shiffrin, 1968). However these traditional laboratory experiments ignored episodic memory, (personal memories, Neisser 1978). The original experiments lacked ecological value, however held important discoveries that would frame the nature of research for further investigation into the complexity of human memory. Koriat and

Goldsmith, 1996a suggested transferring from storehouse metaphors to correspondence metaphors, and check any prevalent differences between individual reports and the actual occurrence, i.e., eyewitness testimony.

Wells and Olsen in 2003 found that 75% of convictions had been falsely accused due to eyewitness testimony (Wells and Olsen 2003), DNA testing later confirmed these accusations to be mistaken. Kassin, 2001 and Koriat, A., & Goldsmith, M. (1996b) concluded that there was no correlation between confidence and accuracy in eyewitness testimonies, and meticulous identification of suspects is as low as 40%. This implies the inaccuracy surrounding eye witness testimonies and the risk of false accusations and convictions. Steblay 1994, presented numerous suggestions to lower the percentage of false accusations, including encouraging the witness to provide their own information, to ask as many open ended questions, and to avoid the use of leading questions, caution the witness against estimations, etc. These measures have found to decrease false identifications by as much as 42% in culprit line-up.

In an experiment by Loftus, E. F., & Pickrell, J. E. (1995), they asked participants to recall 72 true events that took place in a shopping centre and also questions about a false event, 69% of the true events were successfully remembered and 29% of participants recalled false events. Loftus, E. F. (1997) also conducted an experiment investigating the creation of false memories using a list of words. In the second experiment, consisting of 15-word lists, false recall rates in participants increased, occurring a total of 55% of the occasions. Loftus conducted mass amounts of research into the topic of false memory and eyewitness testimony. Another study by Roediger and McDermott in 1995 (based upon the study by Deese's study in 1959 (Deese, J. (1959)) found participants remembering events that never happened (Roediger, H. L., & McDermott, K. B. (1995)).

This has many implications that memory is not completely accurate nor necessarily reliable in cases of law enforcement and eye witness testimonies, as leading questions can increase chances of one's personal memory changing thus encouraging the formation of false memories. This current research is referring to the working memory in terms of false memory creations, as it is a cognitive system with a limited capacity, and focuses on the current information presented. Working memory however can be affected by stress levels. Schoofs, D., Preuß, D., & Wolf, O. T. (2008) found that when given a memory task, participants stress levels negatively impacted their working memory functioning. This would thus impact one's sensitivity to the creation of false memory.

Stress is a normal response linked to potentially dangerous situations, complex family life, strainuos relationships, etc. Roozendaal, B. 2002 examined adrenal hormones that are released during stressful events and how they influence one's efforts to cope, or to deal with said stress. It has been researched that these hormones result in the consolidation or storage of novel information, in some cases both; (Bohus, 1994; McGaugh, Cahill, & Roozendaal, 1996; McGaugh & Roozendaal, 2002). These hormones, e.g, catecholamines or glucocorticoids, can impact memory function by affecting the limbic structure of the brain. Studies by (Cottrell & Nakajima, 1977; Sandi & Rose, 1994) investigated glucocorticoid-induced memory enhancement, however if was found by numerous papers the potentially disruptive effects on ones memory, (Newcomer, Craft, Hershey, Askins, & Bardgett, 1994; Kirschbaum, Wolf, May, Wippick, & Hellhammer, 1996).

Stress affects memory performance. It is an area that has been widely researched in many areas. It has been investigated and concluded that there is a significant relationship to stress and emotional memory retrieval, Buchanan, T. W., & Tranel, D. (2008) examined the effects of sex and cortisol responses in relation to memory retrieval and stress. Otto, A. R., et al., 2013 found that stress responses constricted to the contribution of model-based

contributions of behaviour, in effect highlighting the coaction between acute stress and working memory. This current research is an example of investigating one's working memory, using the ability to remember and use relevant information while working in the middle of an activity. When subjected to stress, ones working memory is impaired significantly and memory recall inaccuracy increases (Schoofs et, at., 2008). This leads to questioning the effect of stress and working memory, when investigating the creation of false memory.

One method of measuring one's stress levels is the Perceived Stress Scale (PSS), originally developed in 1983 by Cohen, Kamarch & Mermelstein (Cohen, S., Kamarck, T., & Mermelstein, R. (1983)) and is still widely used to assess people's stress levels today. It is easy to use and to understand with well-established acceptable psychometric properties. Stress has been widely researched and has been associated with various health conditions and illnesses, in conjunction with asthma, cancer rheumatoid arthritis, (Cohen, Janicki-Deverts, & Miller, 2007; Johnson, Perry, & Rozensky, 2002). The perceived stress scale is a "self-reported questionnaire that was designed to measure the degree to which individuals appraise situations in their lives as stressful" (Cohen et al., 1983). Lee, E. H. (2012) conducted various tests including a correlation coefficient (Pearson's Correlation) and found the reliability of the PSS to be >.70 (there were multiple tests all scoring over .70). The validity was also tested and was found to be within the recommended guidelines (the study conducted found the factorial validity to be between 41.6% and 66.7% overall).

Working memory can also be negatively affected by sleep. It was found that sleep deprivation caused a decreased cortisol response to verbal working memory (Mu, Q., et al., 2005). This indicates that one's sleep quality, (positive or negative effect) would have an overall impact on the working memory, and therefore; in theory it would impact false memory likewise. Diekelmann et al 2008 found that sleep loss effectively increased one's

false memory performance. Sleep is essential in memory formation processes, (Cirelli C, Tononi G, 2008). Memories in which are newly required are strengthened during sleep and memory traces are redistributed to alternative brain regions. This is for long term storage and can be integrated with pre-existing long-term memories, "a process termed system consolidation", (Buzsaki G 1998; Smith C 2001; Born J, Rasch B, Gais S 2006; Diekelmann S, Born J 2007). It was reported by Mu, Q et. al, 2005, that sleep deprivation can cause a deficit in performance in multiple cognitive tasks, including memory. However, a study conducted by Fenn, K. M et al., 2009 found that false memory specifically was reduced after sleep in participants. This study used the DRM Task and utilised 10 of the words lists, i.e., 100 words. They also suggested that this outcome could be predicted as memory consolidates studied information, as sleep could potentially "minimise retroactive interference and resultant forgetting" (Wixted, J. T. (2004)). Drosopoulos, S., Wagner, U., & Born, J. (2005) also stated that sleep could also actively consolidate learned information that supports recollection, and thus improve source memory (Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993)). This information eludes the concept that after sleep hinders participants performance in false memory tasks. Another study by Darsaud, A., et al., 2001 found that when participants are given information, regardless of sleep quality the post encoding night, false memory scores are enhanced. From reviewing the literature presented, it highlights inconsistencies within the current research available, indicating an opportunity for further research and examination.

       The relationship between stress and sleep has also been researched. Drake C et al, 2004 found that participants that scored high on stress-related sleep disturbance had increased levels of sleep disturbance in the night spent in the laboratory. Âkerstedt, T. (2006) states that stress causes increased physiological and psychological activation in response to increased environmental insistences. There is a lot of research relating to stress

and sleep in college students, collectively finding that increased stress leads to hindered sleep quality, likewise, controlled stress levels (with various interventions such as yoga, meditation etc.) led to better overall sleep quality; Caldwell, K et al., 2010, Verlander, L. A., Benedict, J. O., & Hanson, D. P. (1999), Sadeh, A., Keinan, G., & Daon, K. (2004). However, it seems as though there is a lack of current and recent research available when relating to stress and sleep, and sleep and memory. This allows for this study to offer updated results on the subject relating to the relationship between the collective variables.

The single item sleep scale is a critically acclaimed method for measuring sleep quality in participants (Snyder, E., et al., (2018)). It is a questionnaire consisting of one question and it includes a direct response, in which the participant rates the overall sleep quality over a 7-day recall period. This is recorded on a scale and the participant is to answer between 0 and 10.

Rationale and research aims/hypotheses: The effect of stress on one's memory is quite evident given the available literature. Sleep also significantly impacted memory and false memory but the results and conclusions varied throughout the research. This research study is to consider the specific relationship and correlations (if present) between false memory, stress levels and sleep quality.

This study is investigating the creation of false memory in participants when controlling for stress, (using the Perceived Stress Scale) and sleep quality, (using the Single-Item Sleep Quality Scale) using The Deese-Roediger-McDermott (DRM) Task. This study also aims to investigate the possibility of contrasting results between male and females in relation to false memory accuracy. Investigating the relationship between sleep stress and false memory aspires to give updated measures and to compare the three variables in one study and hopes to fill the present gaps in the current literature available. Examining differences between men and women aims to add to the current available

research and to eliminate the gap in the literature. Previous studies have used a variety of contrasting measures to conduct research on false memory, for example; auditory, visual, a combination of the two, etc. This study is based on a visual prompt that participants will watch and answer a recall test and a recognition test.

The first hypothesis for this study is that poorer sleep quality and high stress levels will result in a greater amount of false memories in participants. The second hypothesis for this study is that there will be a difference between males and females in the amount of false memory results. The scientific rationale for this study is to make an attempt to investigate the possible relationship and/or correlation between false memory, stress and sleep quality, as there isn't available research examining all three elements to date. The study also has a second hypothesis, which aims to examine the difference (if any) between males and females in relation to the amount of false memory frequencies. The second hypothesis predicts a significant difference between males and females.

Methods

Participants: A total of 109 participants were recruited to complete the online

questionnaire. They were sought mainly through word of mouth, through sharing the link

through means of email and social media. The majority of the people contacted to

complete this study were: fellow college students, family and friends, and work

colleagues. There were a total of 54 females, 38 males and 17 participants' genders were

unaccounted for. The age range was approximately between 18 and 64, however there was

no sufficient data collected to give an accurate result.

Design: This study is of quantitative, experimental, within-participants design.

This means all participants were subjected to all the same conditions, questions and

information. The nature of this study will involve predictor and criterion variables as it is a

regression correlation. The independent (or predictor) variables include the stress levels

and sleep quality of participants and gender. The dependent (or criterion) variables include

the amount of false memory created in participants.

Measures and Materials: The academic materials and measures used to make the

online questionnaire included the PERCEIVED STRESS SCALE by Sheldon Cohen (see

appendix 2) (reliabililty >.70 and validity was found to be within an acceptable range);

Single-Item Sleep Quality Scale (appendix 3); the scale is scored between 0 and 10. 0 =

terrible; 1-3 = poor; 4-6 = fair, 7-9 = good and 10 = excellent. The overall validity of the

scale was found by Snyder, E., et al., (2018) to be significant at all timepoints, ($P < .001$

and the reliability was found to be .62). The Deese-Roediger-McDermott (DRM) Task was

utilised to test false memory, (note only 5 lists were used in this study as to ensure

participants engagement and participation in the study, for reference see appendix 4) . The

recall lists were conducted in a specific order. False words were arranged in places 1, 8

and 10 (Anger in list 1, bread in place 8, etc) and the rest of the words in the list consisted

of 3 words previously seen in the video prompt and 6 random words taken from other

DRM lists, (Fenn, K. M et al., 2009). This was repeated for the 5 lists in the recall segment

of the survey. The elements of the survey consisted of asking the participants for their

consent and agreeing that they were over 18 and their gender. They watched a video of the

50 words, (5-word lists). Then participants answered the single sleep item scale and the

perceived stress scale. Then they were presented with the recall lists and finally asked to

submit the survey. These elements were compiled to create an online survey in which

participants could complete wherever they feel comfortable.

The additional materials used for this project were Google Forms to create the

survey, the app iMovie and a laptop. The layout of the survey was particularly important

as it was to be compiled including a short break or distraction between learning the word

material and recall. Firstly participants were asked to agree to consenting in the survey and

to confirm they are over the age of 18 as well as stating their gender. A short six minute

video was made using iMovie (an app on apple products) consisting of 5 lists of words

from the Deese-Roediger-McDermott (DRM) Task, (to see word lists utilised see appendix

4). This was then included in the survey and participants were asked to state the words that

they immediately remembered from the video.

Next the Perceived Stress Scale (10 questions) and the Single-Item Sleep Quality

Scale (1 question) were completed. These were places in the middle of the survey to act as

a short diversion from the memory element of the test and to encourage false memory

performance later. After this, there was a list of 50 words which were adhered to

specifically from the instructions included in the The Deese-Roediger-McDermott (DRM)

Task. 5 false words (anger, bread, chair, cold and doctor) were placed in specific order (ie.

tenth word presented, along with previously seen words as well as words not previously

presented etc) and the rest of the words both seen and unseen were chosen at random. This completed the survey and participants were asked to submit their responses.

Procedure: Participants would receive the link to this survey, either through means of email, text or social media. They were given information before starting the questionnaire regarding the nature of the study and the purpose behind the research. All participants were asked to agree that they are over the age of 18 and that they consent to participating in this study. They were also informed of withdrawal from the study, indicating that the information already provided would not be included in the data should they wish to withdraw before completing. However, once the participant had clicked submit the answers they had provided would be used in the study. This was all outlined in the information section of the survey, (for further reference see appendix 1). The survey took approximately 10-15 minutes to complete including the time taken to watch the video comprehended. They would then click *submit* at the end of the survey and that completes the procedure for taking part in this research study.

Results

In this study, a total of 109 participants were recruited, 54 females and 34 males. The mean scores for the amount of false memories was 7.36 and the standard deviation was 2.7. The mean scores for stress was 31.23 and the mean for sleep quality was 5.81 (see Table 1 for further details). Preliminary analyses were carried out to ensure no violation of the assumptions of normality, linearity, and homoscedasticity were present. Assumptions of linearity, and homoscedasticity were not violated. A Shapiro Wilk Test showed that the data was not normally distributed (sleep, false memory and gender; $p < .001$).

Hypothesis 1: A multiple regression analysis was performed to determine how well one's false memory results (number of items falsely recalled) could be explained by two predictor variables, including overall sleep quality and stress levels. The correlations between the two predictor variables (stress and sleep quality) and the criterion variable (false memory) included in the study were examined (see Table 2 for further details). Tests for multicollinearity also showed that all Tolerance values (.9 and .9) and VIF (1.1 and 1.1) values were within a respectable range. These results illustrated that there was no violation of the assumption of multicollinearity, and thus the data was applicable for examination through multiple linear regression analysis.

Since no prior hypotheses had been contrived to determine the order of entry of the two predictor variables, a direct method was utilised for the analysis. The two predictor variables explained a total of 17.4% of variance in false memory ($F(3,89) = 6.27$, $p =.001$). Only stress was found to uniquely predict false memory to a statistically significantly level: Stress ($\beta = -.24$, $p = .02$). Sleep quality was not found statistically significant: Sleep Quality ($\beta = -.18$, $p = .08$), (see Table 3 for additional details).

Table 1

Descriptive Statistics

	95% CI	Mean	SD	Median	Maximum	Minimum	N
False Memory	7.84 / 17.63	7.36	2.7	6	15	5	109
Total Stress	-.29 / -.03	31.27	4.08	32	41	21	109
Gender	.66 / 2.88	.59	.49	-	-	-	93
Sleep Quality	-.5 / .03	5.81	2.14	6	10	1	109

Table 2

Correlations Between Predictor Variables

	False Memory	Stress	Sleep Quality
False Memory	1		
Stress	-.15*	1	
Sleep Quality	-.21*	-.31*	1

Note. Statistical significance: *$p < .05$

Table 3

Multiple Regression Model; Predicting False Memory Scores

	R^2	β	B	SE	CI 95% (B)
Model	.17				
Stress		-.24*	-.16	.68	-.29/-.03
Sleep Quality		-.18	-.23	.13	-.5/.02

Hypothesis 2: Since the data was not normally distributed (Shapiro-Wilk Test for gender, false memory and sleep quality P values were <0.05) a Mann-Whitney U Test was conducted to examine the relationship between false memory and gender. The mean rank for males was 37.01 and for females the mean rank was 53.9, (see Table 4). The Mann-Whitney U result = 665.5, the Standardized Test Statistic (z score) = -3.1, and the P value = .002, (see Table 5 for additional information).

Table 4

Mann-Whitney Test Ranks

	Gender	N	Mean Rank	Sum of Ranks
False Memory	Males	38	37.01	1406.5
	Females	55	53.9	2964.5
	Total	93		

Table 5

Test Statistics for normality test

	False Memory
Mann-Whitney U	665.5
Wilcoxon W	1406.5
Z	-3.1
Sig. (2-tailed)	.002

Discussion

Interpretation in terms of empirical evidence: The primary aims of this study focused on investigating the possible relationship between three variables, false memory, perceived stress and sleep quality. A survey consisting of a video of 50 words, recall lists, the perceived stress scale and single item sleep scale was sent to 109 participants over a 4 week time period. The first hypothesis of the study was predicting that poorer sleep quality and higher stress levels would result in an increased amount of false memory answers. The correlations between the predictor variables, sleep quality and stress were significant. Throughout the results of the multiple regression analysis, sleep did not significantly affect the performance of false memory in participants, however stress was found to have statistical significance on ones false memory performance. This indicates that stress has an impact on one's false memory, and additionally that sleep does not have any significant effect on false memory in statistical. The original hypothesis stated that participants stress levels and sleep quality would both have an effect on false memory, whereas the results showed that it was only stress levels had a significant result. Therefore the null hypothesis is rejected.

The null hypothesis is rejected is mainly due to one variable having a statistical significance while the other does not (the null hypothesis refers to nothing changing in the environment, in this case stress and sleep having no effect). In conjunction with past research, these results show both contrasting conclusions as well as similar outcomes to prior research. Diekelmann. S et al., 2008 found that sleep does increase false memory performance, whereas this research found that sleep had no significant effect on one's false memory results. This could be due to the nature of two studies, Diekelmann. S et al., 2008's study was based on sleep deprivation and false memory performance, as opposed to participants weekly overall sleep quality. Both studies used the Deese Roediger

McDermott paradigm, but the general nature of the two studies are too contrasting to come to a reasonable conclusion regarding sleep and false memory. There is little research available claiming that lack of sleep lessens the amount of false memories recorded. The result of this study showed insignificant, possibly indicating there is need for more research, or that this current study was subjected to a limitation of the amount of participants, which will be discussed further in the conclusion report.

These findings do however correlate with previous research suggesting stress levels have significant effects on false memory performance. The results show that higher stress levels in participants results in higher false memory. This study only included 5 out of 15 lists in the DRM paradigm test. Should further research be conducted in the area, the inclusion of additional lists and possible alternating methods, i.e., this study utilised a visual prompt to show the words, however auditory prompts have also been investigated previously and is also an area in need of further examination.

The second hypothesis of this study aspired to investigate the possible differences between males and females in relation to false memory performance. The p values were less the 0.05 and were therefore of statistical significance. Males ranked lower then females, (M = 37.01, F = 53.9), and false memory scores were between 5 and 15 (5 meaning no suceptability to false memory words, 15 meaning higher sucepability to false memory words). This shows that males showcased a higher suscpability to false memory prompts than females. Therefore we reject the null hypothesis. This elludes different results to previous studies showcasing that males and females displayed no differences in false memory production (Bauste, G., & Ferraro, F. R. (2004)). Feingold, A. (1988) found that there were no cognitive differences between males and females in terms of cognitive abilities, including memory. Similarly, there are also studies which found that there is in fact a difference between men and women in memory. A study carried out by Herlitz, A.,

Nilsson, L. G., & Bäckman, L. (1997) found that women performed higher on episodic memory tasks than men. The sample sizes were exceptional, with three hundred and fifty females and over four hundred males. However, in this current study there was a prominent difference between males and females and there were less participants then previous studies. This could be due to the number of males compared to females. Females make up 59% of the participant population while males conclude to 41%.

Limitations/Future Research: There were limitations to this study, including allocated time frame, assumptions of normality and methodology and data collected. This study was confined to a tight time schedule and there was only 4 weeks of data collection. More females in the study could sway the results slightly, and this leaves the opportunity for further research into this topic, considering the variance in research already available and the results of this current study. This study had a sufficient number of participants in the data group to conduct the analysis necessary (multiple regression), however a larger sample size is always recommended to achieve a result that can be generalise to the overall population (relating to sample group). A greater time frame and fewer differences in genders would also improve overall effect sizes also. This study does imply that males and females may not be so alike in memory performance and false memory performance then the majority of research tends to report. This allows for additional research and investigation in the area of gender differences in false memory and memory performance in general.

A larger sample size could also eliminate the obstacle of distribution. The data for this study was skewed, meaning the data was not normally distributed. The general population entails a normal distribution, or a 'bell curve'. This subsequently refrains the data collected from being generalised to the greater population. Should this study be

replicated, a larger sample size should eliminate a skewed distribution and ensure no violations to the assumption of normality are made.

The short time frame also hindered the possible analysis that could have been explored throughout this research. For example, investigating differences between identified age groups could have given a further insight to the relationship between false memory, stress and sleep. Participants age was not recorded due to technological errors, therefore could not be included in the overall analysis. However, this allows for the conduction of further research and investigation into the topic.

The method used for this research consisted of a visual prompt of a video containing 50 words (5-word lists) from the DRM test. It is advised to use all lists if possible, however, to ensure participant engagement, only 5 lists were used in the study. If this area of study were to be investigated further, the use of more words lists is recommended, as well as different methods, perhaps to compare and contrast differences between visual and auditory prompts.

Conclusion: To conclude, this research study in effect found very interesting results. It was used to examine circumstances in which false memories can be prevalent and can act as a first step towards further investigation.

Firstly, false memories can be most impactful in situations of interrogation, most notably police interrogation. It has previously been advised by police department guidelines and policies that suspects should be well rested, as calm as possible, fed good food and given water (when needed) to ensure comfort and optimal results in the interrogation process. False confessions occur when people are wrongly identified through eyewitness testimony, or under stress or overtired. This study supports the reasoning behind stress levels and false memory, however the same can't be said for sleep quality and false memory, as the results showed insignificant results. However this doesn't mean

there is no significant result whatsoever, merely that there was none found during the process of this research.

      This body of work opens multiple questions for further research topics such as; differences between identified age groups, visual prompts in correspondence/contrast to auditory or verbal prompts, alternative methods to studying sleep quality and false memory relations as well as the inter-relationships between false memory, stress levels and sleep quality. These questions could provide additional information to situations in which false memories can cause significant issues, the main examples being police interrogations, false confessions, etc. When reviewing the limitations to this study, there are ways in which this study could be improved upon and built on further. Following reccommendations made for future studies offers alternative methods for more research topics, findings and allows for reliable and valid results to be found. This would broaden the information available and add to the quality of knowledge attainable.

      Overall, this study concluded that stress levels and false memory had a relationship found to be of statistical significance, and leaves the opportunity for additional research into numerous areas and topics.

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Appendix

Appendix 1

Information and Consent Form

My name is Amanda Jones, I'm a third year undergraduate psychology student, studying at the National College of Ireland.

This is a research investigating relationships between stress, sleep and false memory, seeing the relationship between them and possible discrepancies between males and females. It will include watching a 6 minute video where 5 lists of 15 words are presented on the screen. Then a short stress scale and sleep questionnaire will be completed, you will then be asked to type and/or write down all the words you remember and finally there will be a recognition test. The experiment should take approximately 10 to 15 minutes. This study has been approved by the Department of Ethics Committee.

Please note you must be over the age of 18 to participate in this study. You are also allowed to withdraw from this study at any given time, however once submitted your data cannot be withdrawn as it will be fully anonymised. You will not be identifiable in any way. There are no known risks with taking part in this study, this study is researching memory and does include a questionnaire relating to stress, which may be a sensitive topic to some people.

Appendix 2

Perceived Stress Scale

l. In the last month, how often have you been upset because of something that happened unexpectedly? _____

2. In the last month, how often have you felt that you were unable to control the important things in your life? _____

3. In the last month, how often have you felt nervous and stressed? _____

4. In the last month, how often have you felt confident about your ability to handle your personal problems? _____

5. In the last month, how often have you felt that things were going your way? _____

6. In the last month, how often have you found that you could not cope with all the things that you had to do? _____

7. In the last month, how often have you been able to control irritations in your life? _____

8. In the last month, how often have you felt that you were on top of things? _____

9. In the last month, how often have you been angered because of things that happened that were outside of your control? _____

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? _____

You can determine your PSS score by following these directions: First, reverse your scores for questions 4, 5, 7, and 8.

On these 4 questions, change the scores like this: $0 = 4$, $1 = 3$, $2 = 2$, $3 = 1$, $4 = 0$.

Scores ranging from 0-13 would be considered low stress; scores ranging from 14-26 would be considered moderate stress; scores ranging from 27-40 would be considered high perceived stress.

Appendix 3

Single- Item Sleep Quality Scale

During the past 7 days, how would you rate your sleep quality overall? (select a number

between 0-10)

Terrible 0 1 2 3 4 5 6 7 8 9 10 *Excellent*

The scale is scored between 0 and 10.

0 = terrible; 1-3 = poor; 4-6 = fair, 7-9 = good and 10 = excellent

Apendix 4

Deese Roediger-McDermott (DRM) Task

These words there presented in the order shown below in a video format (made with the app iMovie), without the false words included (anger, bread, chair, cold and doctor). After completing the perceived stress scale and the single item sleep sleep scale, participants would then be shown another fifty words, including; false memory words; words from the selected lists below; as well as other words selected at random from alternative word lists found in a paper by Fenn, K. M et al., 2009. The false memory words were placed in a specific order, in places 1, 8 and 10 throughout the recall test.

Deese-Roediger-McDermott (DRM) Task (false words in italics; not included in the video prompt but incorporated in recall test)

List 1	List 2	List 3	List 4	List 5
Anger	*Bread*	*Chair*	*Cold*	*Doctor*
Mad	Butter	Table	Hot	Nurse
Fear	Food	Sit	Snow	Sick
Hate	Eat	Legs	Warm	Lawyer
Rage	Sandwich	Seat	Winter	Medicine
Temper	Rye	Couch	Ice	Health
Fury	Jam	Desk	Wet	Hospital
Ire	Milk	Recliner	Frigid	Dentist
Wrath	Flour	Sofe	Chilly	Physician
Happy	Jelly	Wood	Heat	Ill
Fight	Dough	Cushion	Weather	Patient
Hatred	Crust	Swivel	Freeze	Office
Mean	Slice	Stool	Air	Stethoscope
Calm	Wine	Sitting	Shiver	Surgeon
Emotion	Loaf	Rocking	Artic	Clinic
Enrgage	Toast	Bench	Frost	Cure