The impact of stress and warning on the creation of false memories

Íris Ösp Ólafsdóttir

2012

BSc in Psychology

Author: Íris Ösp Ólafsdóttir
ID number: 060589-2599
Supervisor: Kamilla Rún Jóhannsdóttir

Department of Psychology
School of Business

Útdráttur

Tilgangur þessarar rannsóknar var að skoða áhrif streitu og viðvörunar á myndun falskra minninga sem og fjölda réttra orða sem eru endurheimt. Þátttakendur voru 60 talsins, 11 karlar og 49 konur og var skipt tilviljunarkennt í fjóra hópa; samanburðarhóp, hóp sem var varaður við myndun falskra minninga, hóp sem var settur í streituvaldandi aðstæður og að lokum hóp sem fékk viðvörun og var settur í streituvaldandi aðstæður. Niðurstöðurnar sýndu að tálorð (fölsk orð munuð) voru mynduð í 22% tilfella og réttu orðin voru munuð í 54% tilfella. Einnig sýndu niðurstöðurnar að þátttakendur voru jafn líklegir til þess að mynda falska minningu þrátt fyrir að vera varaðir við og að streita hafði ekki áhrif á myndun falskra minninga. Þeir þátttakendur sem fengu bæði viðvörun og voru settir í streituvaldandi aðstæður mundu fleiri tálorð heldur en aðrir en sá munur var ekki marktækur. Hins vegar, hafði viðvörun marktæk áhrif á fjölda réttra orða sem þátttakendur gátu endurheimt.

Abstract

The purpose of this study was to analyse the impact of stress and warning on creation of false memories and correctly recalled words. Participants were 60 in total, 11 males and 49 females. Participants were randomly divided into four groups; group that received stress and warning, group that received stress, group that received warning and group that received neither stress nor warning. The results showed that the non-presented critical words were recalled in 22% of cases and studied words were correctly recalled in 54% of cases. The results also showed that warning and stress did not have a significant impact on the creation of false memories, although there was a trend towards greater impact of warning on those participants who received stress compared to those participants who did not receive stress. Warning did have a significant impact on studied words where those participants who received warning recalled fewer studied words compared to those who didn’t receive warning. Lack of significant impact of warning and stress on false memory might be due to too few participants in each group.

Foreword and Acknowledgement

Submitted in partial fulfillment of the requirements of the BSc Psychology degree, Reykjavík University, this thesis is presented in the style of an article for submission to a peer-reviewed journal.

I would like to thank my supervisor Kamilla Rún Jóhannsdóttir Ph.D, for her guidance, great support and good advise throughout this project. I would also like to thank all my participants, but their participation made my project possible. As well I want to thank Ásgeir Erlendsson for pre-recording all the word lists that were used in the research. Finally I want to thank my family for supporting me while working on this project and during my studies in the psychology program at Reykjavík University. Without all this support it would have been hard for me to finalize this project.

The concept of false memories refers to when people remember events that never happened or that they remember them quite differently from the way they actually happened (Roediger & McDermott, 1995). In recent years there has been an increased interest in when and why people form false memories (e.g. Roediger & McDermott, 1995 & Loftus, 1992).

Deese was the first to introduce thematic word lists in 1995 in order to analyse false memories (see Roediger & McDermott, 1995). His method involved using thematic word lists where all the words are similar to one critical word. For example, for the critical word *sleep*, the list words were *bed, rest, awake, tired, dream, wake, snooze, blanket, doze, slumber, snore, nap, peace, yawn and drowsy* (Roediger & McDermott, 1995). Deese developed 36 word lists, each list contained 12 words and were related to one critical word. All the words on the lists were read out loud for the participants except for the critical word (which will from now on be referred to as *the non-presented critical word*). Deese believed that the thematic word lists would lead to the participants thinking that they had heard the non-presented critical word read out loud. When each word list had been read out loud the participants were supposed to use *free recall* to write down the words they thought they had heard. The non-presented critical word, which quite frequently was written down by the participants, is classified as *false memory* (as discussed in Roediger & McDermott, 1995).

Roediger and McDermott (1995) based their study on Deese's thematic lists. Roediger and McDermott created 24 thematic word lists, which contained 15 words each. The words in the lists were all strongly related to one non-presented critical word. In their experiment they used six word lists from Deese (1959), which had shown the highest frequency of false recall. Roediger and McDermott used both free recall and recognition test to see if participants recalled the non-presented critical word. The results showed that the non-presented critical word was falsely recognized in 40% of cases and was recognized more frequently than non-studied words presented on the recognition test. Their findings confirmed the results from

Deese's studies of high levels of false memories in a single-trial free recall task. In addition, Roediger and McDermott found that the non-presented critical word was recalled at almost the same level as items that were presented in the middle of the list. The non-presented critical word was also recalled more often than other similar words that were not presented in the list. Furthermore, more than half of the participants were sure that the non-presented critical word had appeared in the list.

Gallo, Roberts and Seamon (1997) performed a research to see if something could prevent individuals from creating false memories. They divided the participants into three groups. The first group was not told about the false recognition effect, but they were given standard instructions instead and instructed to try to remember as many words as possible for the recognition test. In the second group the participants were informed to be careful on the recognition test to reduce their false recognition. The third group was forewarned about the false recognition with detailed information and examples. The participants in the third group were specifically told that the study lists were designed to try to make them falsely recognize related but non-presented critical words. This condition allowed participants the chance to devise strategies to reduce or eliminate the false recognition effect. Results from the study revealed that when participants were uninformed about the false memories, they established a strong false recognition effect. The results from the second group indicated that when participants were asked to be careful on the recognition test it reduced the hit rates for the studied words as well as reducing the participant´s recognition regarding the non-presented critical words. However, asking participants to be cautious did not prevent them from creating false memories.

Watson, Bunting, Poole and Conway (2005) examined whether individuals' working memory span would affect the extent to which a warning could be used to reduce the false memory effect. Their results revealed that those participants with a high working memory

span created less false memories but only if they received a warning. That is individuals with a low working memory span are unlikely to reduce the creation of false memories even if they are warned about the false memory effect. Participants with a high working memory span also recalled more studied words than the participants with a low working memory span regardless of whether they received a warning or not.

The existing literature on false memories suggests that the false memory effect is a robust effect not controlled by working memory capacity and not easily avoided even when participants are warned about the effect. But more studies are needed to further examine false memories and when and how they are created. For example, one topic of interest would be to analyse the impact of stress on false memories. This would both have applied relevance (e.g. stressful questioning of a witness) but also theoretical as studies suggest both that stress to a point can increase cognitive performance (Milkman & Sunderwirth, 2010) and also a high level of stress can impair cognitive performance (Lupien & McEwen, 1997; Vedhara, Hyde, Gilchrist, Tytherleigh & Plummer, 2000). For example, research has shown that acute high-levels of cortisol in humans, which is a stress hormone, affects both memory and cognition (Lupien & McEwen, 1997). Research by Vedhara et.al., (2000) showed that stress has been found to influence each memory phase in a different way, where performance on short-term memory increased and performance on selective attention and divided attention deteriorated when participants were stressed. However, in this research the stress did not seem to have an impact on working memory.

Oei, Everaerd, Elzinga, Van Well and Bermond (2006) found that stress does decrease performance on a difficult working memory task but does not have an impact on an easy working memory task. The impact of stress on working memory may therefore depend on the difficulty level of the task, or possibly on the method used to stress the participants.

Stress, or high levels of glucocorticoids, also seems to affect participants' performance on the false memory test (Payne, Nadel, Allen, Thomas & Jacobs, 2002). Even moderate stress levels can impair memory function (de Quervain, Roozendaal, Nitsch, McGaugh & Hock, 2000). Payne et.al., (2002) examined whether induced stress would have an impact on the creation of false memories. The participants' stress was induced by using the Trier Social Stress Test (Kirschbaum, Pirke & Hellhammer, 1993), which involved participants needing to prepare a speech for ten minutes and then deliver that same speech in five minutes in front of a one-way mirror where three trained investigators were on the other side to evaluate. The Deese-Roediger-McDermott word lists were used in order to try to elicit false memories. The results revealed that stress did not have an impact on the accuracy of the memory for studied words. However, stress did increase the false recognition rate were the stressed participants falsely recognized the non-presented critical words in 77% of cases compared to 61% for the non-stressed participants. This is a very high rate of false memories and much higher than Roediger and McDermott (1995) were getting in their research.

The varied impact of stress on different cognitive components could be explained partially by different types of methods used in order to induce participants' stress. The Trier Social Stress Test (Kirschbaum et.al., 1993) is the most commonly used method and is the same one that Oei et.al., (2006) and Payne et.al., (2002) used in their research. Researchers have also used the mental arithmetic's task (Allen, Bocek & Burch, 2011) or even just measure the participants stress condition for the last 30 days by using the Cohen perceived stress scale like Vedhara et.al., (2000) did in their research.

Previous research has shown that false memories are robust and not prevented by warning or working memory capacity (Gallo et.al., 1997; Watson et.al., 2005; Oei et.al., 2006). Stressed participants are also more likely to create false memories compared to non-stressed participants (Payne et.al., 2002). The goal of this study is to examine the impact of warning

and stress on false memory creation and correctly recalled words and to see if stressed participants are less likely to use warning to prevent false memories compared to non-stressed participants.

Research has shown that when individuals are stressed their performance of both everyday tasks of selective and divided attention decreases (Vedhara et.al., 2000). Therefore when individuals are stressed they will face attention narrowing which consequently reduces their ability to focus on other factors (Vedhara et.al., 2000). Based on research by Payne et.al., (2002) stressed individuals are at a high risk for creating false memories and therefore it is important to analyse if warning could prevent them from creating false memories. It is also important to look at the effect of warning on memory and false memories when using free recall. Studies have mostly used recognition tests although Watson et.al., (2005) used free recall.

The following hypotheses were tested: 1) Stressed participants who receive warning are more likely to create false memories compared to those participants who receive warning but no stress. 2) Those participants who receive warning about false memories create less false memories compared to those who don't receive warning. 3) Those participants who receive warning recall fewer studied words compared to those who don't receive warning.

Method

Participants

The participants were 60 in total, 11 males and 49 females and ranged in age from 19-45 years (M=25,48 years). The participants were healthy undergraduate students from Reykjavík University who participated as volunteers. The participants were randomly divided into four groups with 15 participants in each group. The first group received stress and warning, the second group received stress, the third group received warning and the fourth group received

neither stress nor warning. Participants did not receive anything for participating in this study.

Materials

Thematic word lists

The thematic word lists that were used in this study were 15 and each list contained 15 words. The words in the lists were all strongly related to one non-presented critical word. For example, for the critical word sleep, the list words were *bed, rest, awake, tired, dream, wake, snooze, blanket, doze, slumber, snore, nap, peace, yawn* and *drowsy*. Six of the word lists that were used were obtained from Deese 1959 study (see Roediger & McDermott, 1995). These word lists were *chair, mountain, needle, rough, sleep* and *sweet* and they produced the highest frequency of false memories in Deese study (see appendix A). The other nine word lists that were used were obtained from Roediger and McDermott (1995) study. These word lists were *doctor, king, fruit, music, black, cold, girl, man* and *window* (see appendix A).

Stress task

The participants in the stress groups performed a mental arithmetic's task were they had to count down in increments of 13 from the number 1724 as quickly as possible. The participants had 3 minutes to perform the task and if they made a mistake the researcher corrected them with the right number. In order to make the task situation more stressful the participants were told that the mental arithmetic's task was a part of an intelligence test. The researcher also monitored the time and informed the participant regularly about the times left to make the situation even more stressful. The researcher stood behind the participants to avoid any eye contact (Allen et.al., 2011).

Design and procedure

The participants in this study were told that they were participating in a memory research where individuals' memory was being analysed in different situations. Each participant was

tested individually and the study took about 35-40 minutes. When the participants arrived at the laboratory in Reykjavík University they received an information sheet about the study where all the basic information about the research was presented. When the participants had approved participation they signed an informed consent form. The study had approval from the institutional ethics committee.

A 2(warning/no warning) x 2(stress/no stress) between groups ANOVA was used. Participants were divided into four different groups. The division was conducted in the following way: The first participant who entered the laboratory went into the first group, the second participant went into the second group, the third participant in the third group and the fourth participant in the fourth group, this was repeated for every four participants that showed up for the study. The first group received stress and a warning. The stress was induced by using the mental arithmetic's task. The participants were told that the task was a part of an intelligence test and that they had to complete the task within three minutes. While the participants were trying to solve the mental arithmetic's task the researcher kept an eye on time and informed the participants how many minutes they had left. When the three minutes had past the participants were informed that after a few minutes they would hear 15 thematic word list presented by a tape player. The words in the lists were pre-recorded and spoken by a male voice at the rate of 1 word per 1,5 second. Before the word lists were presented participants were told that they would get 45 seconds to recall and write down on a piece of paper the words that they remembered hearing. When word list number one had been presented the researcher told participants that they could begin to recall the words from the list. After the 45 seconds were up word list number two was presented and so on until all the 15 thematic word lists had been presented. Before the word lists were presented the researcher gave the participants general instructions and told them that it would be helpful to write first down the words that were presented last because they were still fresh in memory.

After that they could recall the words in any order. Before the researcher played the thematic word lists participants were given a warning. They were forewarned about that they could remember words that were similar to the words presented in the lists.

The second group received stress but no warning. Participants here received the same instructions as participants in the first group except the second group was not warned about the possibility of falsely recalling related words. The third group received warning but no stress. Those participants did not perform the mental arithmetic's task. They were given the general instructions before the 15 thematic word lists were presented and following the presentation of the lists participants in the third group like the participants in the first group were forewarned that they could remember words that were similar to the words that were presented on the lists. Participants in the fourth group didn't receive any stress or warning. They only had to listen to the thematic word lists and were given the general instruction before the lists were presented.

Statistical Analysis

The non-presented critical words and the studied words were counted for each list for each participant. There was a high number of non-presented words other than the non-presented critical words for each list that were related to the list's theme. These words were counted separately as other non-presented critical words. A word was included as other non-presented critical word if it was directly related to the theme of a list. An example for the thematic word list *sleep*, if the word pillow was written down, which is not presented on the list but is related to the theme (sleep) that word was considered as other non-presented critical word. If the word lamp was written down it was not considered as other non-presented critical word. Percentage of correctly recalled words and critical words was calculated for each participants (number of words compared to total number in a list) and the mean percentage was calculated.

Results

The alpha criterion for significance was set at .05. A 2(warning/no warning) x 2(stress/no stress) between groups ANOVA was calculated separately for non-presented critical words, the other non-presented words and presented words correctly recalled. The mean probability for the critical non-presented words were 22% and also for other non-presented critical words. However the mean probability for studied words was 54%.

Table 1 summarizes the descriptive statistics for the study. The 2(warning/no warning) x 2(stress/no stress) ANOVA for the non-presented critical words revealed a non-significant main effect of warning, $F(1, 56) = .39$, $p = .54$ and a non-significant main effect of stress, $F(1, 56) = 1{,}25$, $p = .27$. The interaction between the variables, warning and stress was also not significant, $F(1, 56) = .25$, $p = .62$. However, as can be seen in figure 1, stressed participants who received warning recalled the non-presented critical words more often (M=3.87, SD=2.386) than those participants that did not receive stress (M=3.27, SD= 2.219).

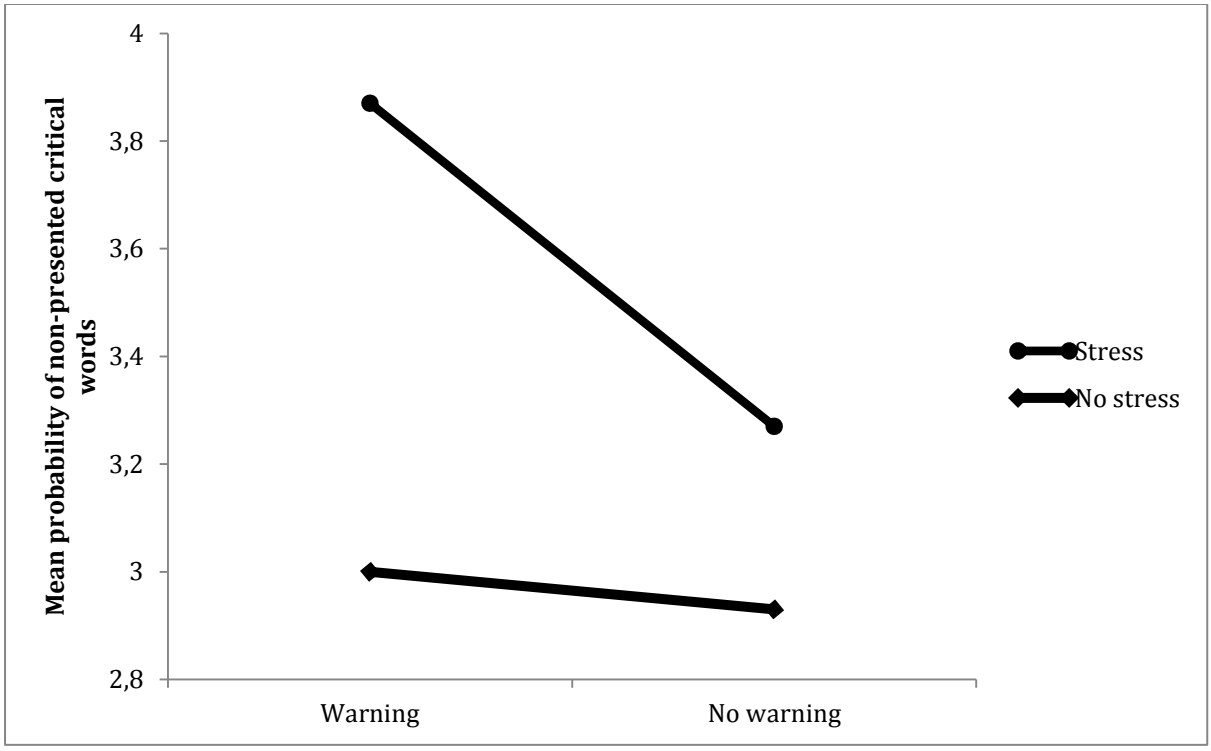

Figure 1. Recall of the non-presented critical words depending on whether participants received warning or not and whether they were stressed or not.

Table 1.

Means and Std. Deviation for non-presented critical words, other non-presented critical words and studied words.

	The non-presented critical words			
	Warning		No warning	
	Mean	Std. Deviation	Mean	Std. Deviation
Stress	3,87	2,386	3,27	2,219
No stress	3	1,89	2,93	1,751

	The other non-presented critical words			
	Warning		No warning	
	Mean	Std. Deviation	Mean	Std. Deviation
Stress	4	3,91	3,13	3,248
No stress	3,27	1,981	2,73	2,017

	The studied words			
	Warning		No warning	
	Mean	Std. Deviation	Mean	Std. Deviation
Stress	115,67	15,249	130,4	12,693
No stress	113,2	13,634	126,2	16,174

The 2(warning/no warning) x 2(stress/no stress) ANOVA for other non-presented words showed a non-significant main effect of warning, $F(1, 56) = .87$, $p = .36$ and a non-significant main effect of stress, $F(1, 56) = .57$, $p = .45$. There was also a non-significant interaction effect between the warning and stress on the creation of other non-presented critical words, $F(1, 56) = .05$, $p = .83$.

The 2(warning/no warning) x 2(stress/no stress) ANOVA for correctly recalled words showed that there was a significant main effect of the warning, $F(1, 56) = 13.71$, $p = .00$. Those participants who received the warning remembered fewer studied words than those participants who did not receive warning (See figure 3). There was a non-significant main effect of stress on the studied words, $F(1, 56) = .79$, $p = .37$. There was also a non-significant interaction effect between the warning and stress on the studied words, $F(1, 56) = .05$, $p = .81$.

Figure 2. Recall of the studied words depending on whether participants received warning or not and whether they were stressed or not.

The results revealed that warning decreases the number of studied words correctly recalled but does not have an impact on the frequency of the non-presented critical words recalled. That is, those participants who received a warning did not recall fewer non-presented critical words compared to those participants who did not received a warning. Stress also did not affect performance on studied or non-presented critical words. However, although not significant those participants who received stress and warning recalled more non-presented critical words compared to those participants who received warning but were not stressed.

Discussion

The results did not support the first hypothesis, as stress did not affect participant's ability to use the warning. It is interesting that stress did not have an impact on the creation of false memories where research by Payne et.al., (2002) showed that stress increased the number of non-presented critical words. The results did however indicate a trend (non-significant) towards stress, having an impact on the creation of false memories when participants also received the warning. Those participants who received warning and stress recalled more non-presented critical words compared to those who did not receive stress, but this interaction effect was not significant, possible due to too few participants in each group (n=15). Research by Watson et.al., (2005) showed that only those participants who had a high working memory span could use warning to reduce the creation of false memories. However, if those participants who had a high working memory span did not receive warning the likelihood of creating false memories was equal to those participants who had a low working memory span. The impact of stress on the ability to utilize warning for reducing the occurrence of false memories needs to be studied further.

The second hypothesis was not supported where those participants who received warning did not recall fewer false memories compared to those participants who did not

receive warning when using free recall. However, research by Gallo et.al., (1997) showed that when participants received detailed warning with examples they recalled a significantly lower rate of false memories than those participants who were asked to be cautious on the recognition test. However, the warning did not prevent participants from creating false memories. The warning that participants received in this study was similar to the warning that Gallo et.al., (1997) used in their research but without examples. It is interesting that when participants received warning without examples it did not have any impact on the creation of false memories. It brings up the question if detailed warning with examples, when participants are shown the list and the critical word, is needed to analyse false memories in order to reduce the recall of the non-presented critical words.

The third hypothesis was supported where those participants who received warning recalled fewer studied words than those participants that didn't receive warning. This is consistent with a research by Gallo et.al., (1997) where they showed the same results. The warning made participants more cautious. If they weren't sure that the word had been presented, they didn't write it down.

Participants recalled a high rate of false memories. The non-presented critical words were recalled in 22% of cases as well as the other non-presented critical words. This is a bit lower than Roediger and McDermott (1995) found in their research were false memories were created in 40% of cases. Payne et.al., (2002) however showed that false memories were recalled in 61% of cases and in 77% of cases when participants were stressed. This is however consistent with research by Watson et.al., (2005) were they found that false memories were recalled in 15-20% of cases when using free recall. The reason why Roediger and McDermott (1995) and Payne et.al., (2002) were getting a higher rate of false memories compared to this study and to Watson et.al., (2005) might be because they used a recognition test after the word lists had been presented instead of using free recall. In the recognition test

the non-presented critical words are presented along with studied words and other critical intrusion words. In the test participants see the non-presented critical words and that could lead to higher recall of it than using free recall. Furthermore it doesn't arise in other researches if the other critical words that are presented in the recognition test are related to the list's theme. If the words were not related to the list's theme it could also be the reason why they were getting a higher rate of false memories.

The results also showed that using the thematic word lists lead participants to think of similar words that were never presented but however, were related to the lists theme. That is consistent to Deese were he believed that the thematic word lists would lead to the participants thinking that they heard the non-presented critical word read out loud (See Roediger & McDermott, 1995). This confirms that using thematic word lists is effective when analysing false memories where they elicit a high level of false memories (Roediger & McDermott, 1995; Gallo et.al., 1997). In light of these results, high levels of individuals create false memories and false memories are something that is real and can not be prevented. Even though the individuals are forewarned about that they might remember something that never happened or they remember them quite differently from the way they actually happened (Gallo et.al., 1997).

Lack of significant impact of warning and stress on false memory might be due to too few participants. The participants were 60 in total and there were four groups with only 15 participants. It is also the first time that the thematic word lists are tested here in Iceland. In light of that the word lists might need to be better reviewed and maybe other words need to be used for Icelandic conditions, where a high number of other non-presented critical words that were related to the theme were recalled. Finally one can also wonder whether the stress was enough to have influenced the participants. It varies whether researchers are inducing participants stress by using different methods or whether they are only measuring the stress

condition that the participants have been experiencing for the last 30 days by using the Cohen stress scale.

In addition it would be interesting to analyse if stressed participants with a high working memory span could use warning about false memories to prevent them from creating false memories. It would also be interesting to measure the stress to see if it is having an impact or use a different approach to induce participants stress even more like using the Trier Social Stress Test which Payne et.al., (2002) used in their research.

References

Allen, M. T., Bocek, C. M., & Burch, A. E. (2011). Gender differences and the relationships of perceived background stress and psychological distress with cardiovascular responses to laboratory stressors. *International Journal of Psychophysiology, 81*, 209-217.

De Quervain, D. F. J., Roozendaal, B., Nitsch, R. M., McGaugh, J. L., & Hock, C. (2000). Acute cortisone administration impairs retreval of long-term declarative memory in humans. *Nature Neuroscience, 3*(4), 313-314.

Gallo, D. A., Roberts, M. J., & Seamon, J. G. (1997). Remembering words not presented in lists: Can we avoid creating false memories? *Psychonomic Bulletin & Review, 4*(2), 271-276.

Kirschbaum, C., Pirke, K. -M., & Hellhammer, D. H. (1993). The 'Trier Social Stress Test' – A Tool for Investigating Psychobiological Stress Responses in a Laboratory Setting. *Neuropsychobiology, 28*, 76–81.

Loftus, E. F. (1992). When A Lie Becomes Memory´s truth: Memory Distortion After Exposure to Misinformation. *Current Directions in Psychological Science, 1*, 121-123.

Lupien, S. J., & McEwen, B. S. (1997). The acute effects of corticosteroids on cognition: Integration of animal and human model studies. *Brain Research Reviews, 24*, 1-27.

Milkman, H. B., & Sunderwirth, S. G. (2010). *Craving for Ecstasy and Natural Highs: A Positive Approach to Mood Alteration.* California: SAGE.

Oei, N. Y. L., Everaerd, W. T. A. M., Elzinga, B. M., Van Well, S., & Bermond, B. (2006). Psychosocial stress impairs working memory at high loads: An association with cortisol levels and memory retrieval. *Stress, 9*(3), 133-141.

Payne, J. D., Nadel, L., Allen, J.J.B., Thomas, K. G. F., & Jacobs, W. J. (2002). The effects of experimentally induced stress on false recognition. *Memory, 10*(1),1-6.

Roediger III, H.L., & McDermott, K.B. (1995). Creating False Memories: Remembering Words Not presented in Lists. *Journal of experimental psychology: Learning, memory and cognition, 21,* 803-814.

Vedhara, K., Hyde, J., Gilchrist, I. D., Tytherleigh, M., & Plummer, S. (2000). Acute stress, memory, attention and cortisol. *Psychoneuroendocrinology, 25,* 535-549.

Watson, J. M., Bunting, M. F., Poole, B. J., & Conway, A. R. A. (2005). Individual Differences in Susceptibility to False Memory in the Deese-Roediger-McDermott Paradigm. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31*(1), 76-85.

Appendices

Appendix A

Needle	Doctor	King	Sleep	Chair
Thread	Nurse	Queen	Bed	Table
Pin	Sick	England	Rest	Sit
Eye	Lawyer	Crown	Awake	Legs
Sewing	Medicine	Prince	Tired	Seat
Sharp	Health	George	Dream	Couch
Point	Hospital	Dictator	Wake	Desk
Prick	Dentist	Palace	Snooze	Recliner
Thimble	Physician	Throne	Blanket	Sofa
Haystack	Ill	Chess	Doze	Wood
Thorn	Patient	Rule	Slumber	Cushion
Hurt	Office	Subjects	Snore	Swivel
Injection	Stethoscope	Monarch	Nap	Stool
Syringe	Surgeon	Royal	Peace	Sitting
Cloth	Clinic	Leader	Yawn	Rocking
Knitting	Cure	Reign	Drowsy	Bench

Mountain	Rough	Sweet	Fruit	Music
Hill	Smooth	Sour	Apple	Note
Valley	Bumpy	Candy	Vegetable	Sound
Climb	Road	Sugar	Orange	Piano
Summit	Tough	Bitter	Kiwi	Sing
Top	Sandpaper	Good	Citrus	Radio
Molehill	Jagged	Taste	Ripe	Band
Peak	Ready	Tooth	Pear	Melody
Plain	Coarse	Nice	Banana	Horn
Glacier	Uneven	Honey	Berry	Concert
Goat	Riders	Soda	Cherry	Instrument
Bike	Rugged	Chocolate	Basket	Symphony
Climber	Sand	Heart	Juice	Jazz
Range	Boards	Cake	Salad	Orchestra
Steep	Ground	Tart	Bowl	Art
Ski	Gravel	Pie	Cocktail	Rhythm

Black	Cold	Girl	Man	Window
White	Hot	Boy	Woman	Door
Dark	Snow	Dolls	Husband	Glass
Cat	Warm	Female	Uncle	Pane
Charred	Winter	Young	Lady	Shade
Night	Ice	Dress	Mouse	Ledge
Funeral	Wet	Pretty	Male	Sill
Color	Frigid	Hair	Father	House
Grief	Chilly	Niece	Strong	Open
Blue	Heat	Dance	Friend	Curtain
Death	Weather	Beautiful	Beard	Frame
Ink	Freeze	Cute	Person	View
Bottom	Air	Date	Handsome	Breeze
Coal	Shiver	Aunt	Muscle	Sash
Brown	Arctic	Daughter	Suit	Screen
Gray	Frost	Sister	Old	Shutter

Nál	Læknir	Kóngur	Svefn	Stóll
Þráður	Hjúkrunarfræðingur	Drottning	Rúm	Borð
Tvinni	Veikur	England	Hvíld	Sitja
Auga	Lögfræðingur	Kóróna	Vakandi	Fætur
Sauma	Læknisfræði	Prins	Þreyttur	Sæti
Beittur	Heilsa	Hákon	Draumur	Dívan
Oddur	Spítali	Einræðisherra	Árvökull	Skrifborð
Prik	Tannlæknir	Höll	Dúr	Þægindi
Þræða	Heimilislækningar	Hásæti	Teppi	Sófi
Heystakkur	Veikindi	Skák	Blundur	Viður
Þyrnir	Sjúklingur	Stjórn	Dotta	Seta
Sársauki	Skrifstofa	Þegn	Hrjóta	Snúningur
Stinga	Hlustunarpípa	Einvaldur	Lúra	Kollur
Sprauta	Skurðaðgerðir	Konunglegur	Friður	Stilla
Efni	Heilsugæsla	Leiðtogi	Geispi	Rugga
Prjóna	Lækning	Ríkja	Sifjaður	Bekkur

Fjall	Hrjúfur	Sætur	Ávextir	Tónlist
Hæð	Sléttur	Súr	Epli	Nóta
Dalur	Holóttur	Sælgæti	Grænmeti	Hljóð
Klifur	Vegur	Sykur	Appelsína	Píanó
Tindur	Harður	Beiskur	Kiwí	Söngur
Toppur	Sandpappír	Gott	Sítróna	Útvarp
Moldvörpuhaugur	Skörðóttur	Bragð	Þroskaður	Band
Fjallstindur	Tilbúinn	Tönn	Pera	Lag
Slétta	Grófur	Indæll	Banani	Horn
Jökull	Ójafn	Hunang	Ber	Tónleikar
Geit	Reiðmaður	Gos	Kirsuber	Hljóðfæri
Reiðhjól	Harðgerður	Súkkulaði	Karfa	Sinfónía
Fjallgöngumaður	Sandur	Hjarta	Djús	Jazz
Fjallgarður	Borð	Kaka	Salat	Hljómsveit
Brattur	Jörð	Terta	Skál	List
Skíði	Möl	Ávaxtabaka	Kokteill	Taktur

Svartur	Kuldi	Stelpa	Maður	Gluggi
Hvítur	Hiti	Strákur	Kona	Hurð
Dökkur	Snjór	Dúkka	Eiginmaður	Gler
Brenndur	Hlýja	Kona	Föðurbróðir	Rúða
Nótt	Vetur	Ung	Dama	Skuggi
Jarðarför	klaki	Kjóll	Mús	Klettasylla
Litur	blautur	Sæt	Karlmaður	Sylla
Sorg	Jökulkaldur	Hár	Faðir	Hús
Blár	Napur	Systurdóttir	Sterkur	Opið
Dauði	varmi	Dans	Vinur	Gardína
Blek	veður	Falleg	Skegg	Rammi
Botn	Frjósa	Snotur	Manneskja	Útsýni
Kol	Loft	Stefnumót	Myndarlegur	Andvari
Brúnn	Hrollur	Móðursystir	Vöðvar	Hurðarkarmur
Grár	Ískaldur	Dóttir	Jakkaföt	Hlíf
	Frost	Systir	Gamall	Hleri

Appendix B

Hversu gott er þitt minni? Rannsókn á minni í mismunandi aðstæðum

Þér er boðið að taka þátt í rannsókn. Áður en þú ákveður hvort þú viljir taka þátt er mikilvægt að þú skiljir afhverju verið er að gera rannsóknina og hvað hún felur í sér. Þetta upplýsingablað segir þér allt um tilgang, áhættu og ávinning af þessari rannsókn. Ef þú samþykkir að taka þátt, munt þú vera beðin um að skrifa undir upplýst samþykki. Ef eitthvað er óljóst, er þér velkomið að hafa samband. Vinsamlegast taktu eins mikinn tíma og þú þarf til þess að lesa þessar upplýsingar. Þú ættir aðeins að fallast á þátttöku í þessari rannsókn þegar þú finnur að þú skilur hvers er ætlast til af þér og þú hefur haft nægan tíma til að hugsa um þessa ákvörðun.

Tilgangur rannsóknarinnar

Tilgangur rannsóknarinnar er sá að skoða frammistöðu einstaklinga á ákveðnum minnisverkefnum. Þér ásamt u.þ.b. 60 öðrum nemendum við Háskólann í Reykjavík er boðið að taka þátt í rannsókninni séu þeir á aldrinum 18-55 ára.

Hvað felur þátttakan í sér?

Rannsóknin felur í sér að lesnir verða upp 15 orðalistar og eftir að hver og einn listi hefur verið lesinn upp færð þú 45 sekúndur til þess að skrifa niður á blað öll þau orð sem þú manst. Rannsóknin tekur í heildina u.þ.b. 40-45 mínútur.

Þarf ég að taka þátt?

Það er alfarið undir þér komið að ákveða hvort þú viljir taka þátt í þessari rannsókn. Ef þú ákveður að taka þátt, verður þú beðin(n) að skrifa undir upplýst samþykki. Ef þú ákveður að taka þátt er þér frjálst að hætta hvenær sem er og án þess að gefa ástæðu fyrir því. Sú ákvörðun að hætta á meðan á rannsókninni stendur eða ef þú ákveður að taka ekki þátt, mun það ekki hafa neinar afleiðingar í för með sér.

Hvað felur það í sér fyrir mig ef ég tek þátt?

Það sem felst í þátttöku þinni er að mæta í aðeins eitt skipti á tilraunastofu sem staðsett er í Háskólanum í Reykjavík, en þar fer rannsóknin fram. Lesnir verða upp fyrir þig 15 orðalistar með jöfnu millibili og þitt hlutverk er að muna eins mikið af orðunum og þú getur. Eftir að hver og einn orðalisti hefur verið lesinn upp munt þú fá 45 sekúndur til þess að skrifa niður þau orð sem þú mannst. Eftir að orðalistarnir 15 hafa verið lesnir upp er þátttöku þinni í þessari rannsókn lokið.

Hve lengi mun þátttaka mín í rannsókninni standa yfir?

Rannsóknin tekur um það bil 40-45 mínútur.

Hver er mögulegur ávinningur sem felst í því að taka þátt í rannsókninni?
Sá ávinningur sem felst í því að taka þátt í rannsókninni er í raun sú upplifun að fá að taka þátt í alvöru rannsókn. Enginn beinn ávinningur er fyrir þátttakanda rannsóknarinnar en vísindin öðlast ávinning þar sem við lærum meira um minnið.

Hvaða mögulegu ókostir og áhættur felast í því að taka þátt í rannsókninni?
Það felst engin áhætta í því að taka þátt í rannsókninni en ef svo vill til að þú upplifir einhver óþægindi þá er þér ávalt velkomið að hætta þátttöku hvenær sem er.

Hvað gerist í lok rannsóknarinnar?
Þegar allir þátttakendur hafa verið rannsakaðir, sem ætti að vera innan 6-8 mánaðar frá þátttöku þinni, munt þú fá yfirlit ef þú óskar þess sem nær yfir eina til tvær blaðsíður með helstu niðurstöðum, þar sem aðeins almennar niðurstöður verða kynntar.

Hvað gerist ef mér snýst hugur á meðan rannsókninni stendur?
Þú átt rétt á því að skipta um skoðun hvenær sem er á meðan á þátttöku stendur án einhverra afleiðinga.

Við hvern hef ég samband ef ég hef frekari spurningar eða áhyggjur?
Ef þú hefur frekari spurningar er þér velkomið að hafa samband við Írisi Ösp Ólafsdóttur í tölvupósti: iriso09@ru.is. Einnig er hægt að hafa samband við ábyrgðarmann rannsóknarinnar sem er Dr. Kamilla Rún Jóhannsdóttir í síma 599-6459. Ef þú hefur einhverjar áhyggjur varðandi þessa rannsókn og vilt hafa samband við einhvern í trúnaði, þá er þér velkomið að hafa samband við: **Sálfræðideild Háskólans í Reykjavík.**

REYKJAVÍK UNIVERSITY
HÁSKÓLINN Í REYKJAVÍK

Hversu gott er þitt minni? Rannsókn á minni í mismunandi aðstæðum

Þér er boðið að taka þátt í rannsókn. Áður en þú ákveður hvort þú viljir taka þátt er mikilvægt að þú skiljir afhverju verið er að gera rannsóknina og hvað hún felur í sér. Þetta upplýsingablað segir þér allt um tilgang, áhættu og ávinning af þessari rannsókn. Ef þú samþykkir að taka þátt, munt þú vera beðin um að skrifa undir upplýst samþykki. Ef eitthvað er óljóst, er þér velkomið að hafa samband. Vinsamlegast taktu eins mikinn tíma og þú þarf til þess að lesa þessar upplýsingar. Þú ættir aðeins að fallast á þátttöku í þessari rannsókn þegar þú finnur að þú skilur hvers er ætlast af þér og þú hefur haft nægan tíma til að hugsa um þessa ákvörðun.

Tilgangur rannsóknarinnar

Tilgangur rannsóknarinnar er sá að skoða frammistöðu einstaklinga á ákveðnum minnisverkefnum. Þér ásamt u.þ.b. 60 öðrum nemendum við Háskólann í Reykjavík er boðið að taka þátt í rannsókninni séu þeir á aldrinum 18-55 ára.

Hvað felur þátttakan í sér?

Rannsóknin felur í sér að leysa stærðfræðidæmi á tíma. Þátttakandi fær einungis 3 mínútur til þess að reikna stærðfræðidæmið. Eftir að þátttakandi hefur leyst stærðfræðidæmið verða 15 orðalistar lesnir. Eftir að hver og einn listi hefur verið lesinn upp færð þú 45 sekúndur til þess að skrifa niður á blað öll þau orð sem þú mannst. Rannsóknin tekur í heildina u.þ.b. 40-45 mínútur.

Þarf ég að taka þátt?

Það er alfarið undir þér komið að ákveða hvort þú viljir taka þátt í þessari rannsókn. Ef þú ákveður að taka þátt, verður þú beðin(n) að skrifa undir upplýst samþykki. Ef þú ákveður að taka þátt er þér frjálst að hætta hvenær sem er og án þess að gefa ástæðu fyrir því. Sú ákvörðun að hætta á meðan á rannsókninni stendur eða ef þú ákveður að taka ekki þátt, mun það ekki hafa neinar afleiðingar í för með sér.

Hvað felur það í sér fyrir mig ef ég tek þátt?

Það sem felst í þátttöku þinni er að mæta í aðeins eitt skipti á tilraunastofu sem staðsett er í Háskólanum í Reykjavík, en þar fer rannsóknin fram. Þú munt byrja á því að leysa stærðfræðidæmi en því næst verða lesnir upp fyrir þig 15 orðalistar með jöfnu millibili og þitt hlutverk er að muna eins mikið af orðunum og þú getur. Eftir að hver og einn orðalisti hefur verið lesinn upp munt þú fá 45 sekúndur til þess að skrifa niður þau orð sem þú mannst. Eftir að orðalistarnir 15 hafa verið lesnir upp er þátttöku þinni í þessari rannsókn lokið.

Hve lengi mun þátttaka mín í rannsókninni standa yfir?

Rannsóknin tekur um það bil 40-45 mínútur.

Hver er mögulegur ávinningur sem felst í því að taka þátt í rannsókninni?
Sá ávinningur sem felst í því að taka þátt í rannsókninni er í raun sú upplifun að fá að taka þátt í alvöru rannsókn. Enginn beinn ávinningur er fyrir þátttakanda rannsóknarinnar en vísindin öðlast ávinning þar sem við lærum meira um minnið.

Hvaða mögulegu ókostir og áhættur felast í því að taka þátt í rannsókninni?
Það felst engin áhætta í því að taka þátt í rannsókninni en ef svo vill til að þú upplifir einhver óþægindi þá er þér ávalt velkomið að hætta þátttöku hvenær sem er.

Hvað gerist í lok rannsóknarinnar?
Þegar allir þátttakendur hafa verið rannsakaðir, sem ætti að vera innan 6-8 mánaðar frá þátttöku þinni, munt þú fá yfirlit ef þú óskar þess sem nær yfir eina til tvær blaðsíður með helstu niðurstöðum, þar sem aðeins almennar niðurstöður verða kynntar.

Hvað gerist ef mér snýst hugur á meðan rannsókninni stendur?
Þú átt rétt á því að skipta um skoðun hvenær sem er á meðan á þátttöku stendur án einhverra afleiðinga.

Við hvern hef ég samband ef ég hef frekari spurningar eða áhyggjur?
Ef þú hefur frekari spurningar er þér velkomið að hafa samband við Írisi Ösp Ólafsdóttur í tölvupósti: iriso09@ru.is. Einnig er hægt að hafa samband við ábyrgðarmann rannsóknarinnar sem er Dr. Kamilla Rún Jóhannsdóttir í síma 599-6459. Ef þú hefur einhverjar áhyggjur varðandi þessa rannsókn og vilt hafa samband við einhvern í trúnaði, þá er þér velkomið að hafa samband við: **Sálfræðideild Háskólans í Reykjavík.**

Appendix C

REYKJAVÍK UNIVERSITY
HÁSKÓLINN Í REYKJAVÍK

Upplýst samþykki

Heiti verkefnis: Hversu gott er þitt minni? Rannsókn á minni í mismunandi aðstæðum.

Nafn rannsakanda: Íris Ösp Ólafsdóttir

Vinsamlegast merktu við

1. Ég staðfesti að ég hafi lesið upplýsingablaðið fyrir eftirfarandi rannsókn og að ég hafi haft tækifæri til þess að spyrja spurninga. ☐

2. Ég staðfesti að ég hef skilið þær upplýsingarnar sem hafa verið gefnar og hef haft nægan tíma til þess að íhuga upplýsingarnar. ☐

3. Ég skil að þátttaka mín er valfrjáls og að mér er frjálst að hætta á hverri stundu, án þess að tilgreina ástæðu, og án þess að lagaleg réttindi mín verði fyrir áhrifum. ☐

4. Ég samþykki að taka þátt í ofangreindri rannsókn. ☐

Nafn þátttakanda	Dagsetning	Undirskrift
Rannsakandi	Dagsetning	Undirskrift

Appendix D

REYKJAVÍK UNIVERSITY
HÁSKÓLINN Í REYKJAVÍK

Samantekt rannsóknar

Heiti rannsóknar: Áhrif streitu og viðvörunar á myndun falskra minninga.

Rannsakandi: Íris Ösp Ólafsdóttir

Leiðbeinandi: Dr. Kamilla Rún Jóhannsdóttir

Markmið rannsóknar:

Endurheimt minninga er mikilvægur þáttur í lífi einstaklinga og því er mikilvægt að vita hvort við getum treyst þeim minningum sem eru endurheimtar. Undanfarin ár hafa sálfræðingar rannsakað falskar minningar til að öðlast betri skilning á því afhverju minnið okkar gefur sig. Fyrri rannsóknir hafa sýnt að viðvörun getur dregið úr myndun falskra minninga en þó frekar fyrir þá sem eru betri í að stjórna athyglinni. Í þessari rannsókn voru áhrif viðvörunnar á minni og myndun falskra minninga skoðað hjá íslenskum háskólanemum. Einnig var skoðað hvort að streita hafi áhrif á getu þátttakenda til að nýta sér viðvörun um falskar minningar.

Niðurstöður:

Niðurstöður sýndu að íslenskir háskólanema mynduðu falskar minningar þrátt fyrir að vera varaðir við þeim möguleika fyrir fram. Einnig hafði viðvörun þau áhrif á þátttakendur að þeir mundu færri orð almennt samanborið við þá þátttakendur sem ekki fengu viðvörun. Streita hafði ekki marktæk áhrif á getu þátttakenda til þess að nýta sér viðvörun hins vegar voru þeir þátttakendur sem fengu streitu og viðvörun líklegri til þess að mynda fölsk orð. Í ljósi þessara niðurstaðna eru falskar minningar raunverulegar og ekki virðist væra hægt að koma í veg fyrir myndun þeirra og því er ekki hægt að treysta öllum þeim minningum sem endurheimtar eru.

Undirskrift

Rannsakandi: Íris Ösp Ólafsdóttir **Leiðbeinandi:** Dr. Kamilla Rún Jóhannsdóttir

Takk fyrir. Þátttaka þín í verkefninu er mikils metin. Ef þú hefur einhverjar athugasemdir varðandi verkefnið ekki hika við að hafa samband við Sálfræðideild Háskólans í Reykjavík