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“Effects of mental checking during anxious anticipation on meta- memory”

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June 2009

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Abstract

Previous studies have found that repeated checking leads to a decrease in memory confidence, which in turn leads to increased perseverative checking. OCD patients perform physical checking as well as mental checking. The latter is a form of covert checking, by which memories of specific parts of a situation are repeatedly recalled.

Research indicates that taxing of the working-memory and simultaneous recalling a memory makes this memory less vivid and emotional and it will be stored in long term memory likewise. OCD patients are often stressed when they mentally persevere and it is known that stress influences working- memory. It was hypothesized that a taxed working-memory in turn leads to memory distrust. By manipulating stress and mental checking, it was investigated whether vividness, detail and confidence in memory decreases over time. Participants were shown a film and were randomly assigned to one of four conditions: 1) mental checking under stress, 2) mental checking alone, 3) stress manipulation alone, or 4) no manipulation at all.

The stress- manipulation worked, but no significant effect of repeated mental checking on confidence, vividness and detail in memory were found. An effect of accuracy over time was found, which is a normal decay of memory over time. As expected, the mental perseveration had no effects on the accuracy of memory. It can be concluded that our study concerning mental checking did not replicate the results of previous authors that repeated checking is associated with memory distrust. Future research should better investigate the definition of mental checking, since it is still imprecise.

Effects of mental checking during anxious anticipation on meta- memory

1. Introduction

Obsessive compulsive disorder (OCD) is characterized by obsessions and/or compulsions that cause marked distress, are time consuming, or significantly interfere with the person's normal routine, occupational functioning, or usual social activities or relationships (American Psychiatric Association, 1994). OCD patients tend to have heightened senses of both threat and personal responsibility, which may explain why they check matters that others leave unchecked (van den Hout & Kindt, 2004). These patients distrust their own memory and judgement, and often show uncertainty over whether or not they have performed an action. Such uncertainty may develop into obsessional doubts that increase the desire to repeat the action (Dar, 2004; Zitterl et al., 2001).

Checking is an example of a compulsion. A compulsion can be defined as a repetitive (e.g. ordering, checking) or mental act (e.g. praying, counting) that the person feels driven to perform in response to an obsession, or according to rules that must be applied rigidly, which can be overt or covert (American Psychiatric Association, 1994). An example of a covert ritual is mental checking, washing hands is an illustration of an overt ritual (Barlow, 2004).

Intrusions (obsessions) in nonclinical subjects are similar in form and have the same relationship to mood (occur more frequent when one is depressed or anxious) as abnormal, clinical obsessions. Clinical obsessions differ in that they are longer, more intense, more frequent and provoke more discomfort (Mortiz, 2006). Most people use neutralizing strategies to relieve discomfort from intrusions (Rachman and de Silva 1978; Rassin, 2007). The difference with OCD patients is that in normal people the neutralising strategies are more effective, they are more successful in relieving discomfort (Barlow, 2004) and normal people get more confident about the event. This discomfort does not disappear within OCD patients, they still feel unconfident and therefore check repeatedly. OC checkers report even a decrease in confidence (Dar, 2004). Patients with OCD who regularly engage in checking behaviour frequently report that checking often follows an inability to recall whether or not something has been properly checked (Radomsky & Rachman, 2004).

Hermans et. al (2008) give an overview of studies which investigated the hypothesis that OCD patients display global memory deficits. Numerous studies have failed to find objective memory impairments in patients with OCD. Only a few studies have found a memory deficit

in OCD patients and evidence for this is not consistent. There are some problems with the idea that OCD patients have a memory deficit, for example the fact that memory distrust in patients is highly domain specific (van den Hout & Kindt, 2004). Radomsky, Rachman and Hammond (2001) even found a positive memory bias for threat-relevant information when OCD patients are under a condition of high responsibility.

More consistent and robust evidence points to a lack of confidence in the OCD patients memory, rather than an objective deficit in memory itself, that plays a role in the development and/or maintenance of OCD (Radomsky, Rachman & Hammond, 2001; van den Hout & Kindt, 2004; Hermans et al., 2008; Moritz, Ruhe, Jelenik, & Naber, 2009). There seems to be nothing wrong with their memory accuracy, but the patients display poor confidence and/or mistrust in memory (Fricke, Moritz, Jacobson, Willenborg & Jellink, 2006; Moritz et al. 2006; Tolin et al. 2001). Van den Hout & Kindt (2003) suggested that this reduced memory confidence seems to result from the checking behaviour. In this study, memory distrust was investigated by using an interactive computer animation in which normal participants had to perform checking rituals on a virtual gas stove (van den Hout & Kindt, 2003). This experiment showed that repetition of compulsive actions in the experimental group led to decreases in vividness and detail of the recollections and decreases in confidence in memory, while leaving memory accuracy intact. No such effects were found for the control group. Radomsky, Gilchrist, and Dussault (2006) found similar effects employing a real gas stove instead of a computerised version, with a student population. Coles, Radomsky and Horng (2006) have found comparative results for decreased reductions in memory vividness, detail and confidence after repeated checking. Here, a relatively low number of checking trials (e.g. 10) was already enough to decrease memory in healthy subjects. Similarly a review of Muller and Roberts (2005) and a study of Boschen and Vuksanovic (2007) emphasised that repetitive checking is the result of a lack of confidence in recognition memory of OCD patients and they argued that this plays an important role in the development and/or maintenance of the disorder. Hermans et al. (2008) observed that patients suffering from OCD showed less confidence in attention and memory than a clinical and a nonclinical control group, that confidence in attention was uniquely related to checking, and that repeated checking caused increased levels of distrust in attention. These studies suggest that OCD patients are trapped into a vicious circle: physical checking leads to a decrease in memory confidence, which in turn leads to increased checking. So there appears to be a reciprocal relation between checking and confidence in memory.

Besides physical checking, OCD patients also perform mental checking like repeatedly thinking about the situation in which they turned off the gas stove. It seems plausible to expect that the repetition of a recollection like OCD patients do would seem to enlarge memory confidence. Different studies showed that repeated retrieval of memories increases the chance that an event will be stored in long- term memory (Ashcraft, 2002; Karpicke & Roediger, 2006 & 2007). Karpicke and Roediger (2007) even state that repeated retrieval of information is the key to long- term retention, which will give rise to memory confidence (more checking will lead to a stronger and better memory of the event). This positive effect on recall was first observed by Ebbinghaus (1885).

It seems somewhat paradoxical that physical checking leads to decreases in memory confidence while repeated mental checking (repeated retrieval) leads to more memory confidence. A possible solution is offered by the working-memory theory of Baddely (Repovs & Baddely, 2006). The working-memory is a multi-component system that is guided by an executive component, consisting of a number of processes that provide attentional control over other components of working-memory (the phonological loop, the visuospatial sketchpad and the episodic buffer) as well as other cognitive abilities. All the subcomponents of the working-memory have limited capacity memory stores. Multiple studies indicate that effects of different forms of stress influences working- memory (Wolf et al., 2001a, Tops et al., 2004; Young, Sahakian, Robbins, & Cowen, 1999; Lupien et al., 1999). Oei, Everaerd, Elzinga, van Well and Bermond (2006) found that stress impaired working-memory at high loads, but not at low loads in a Sternberg item recognition task. High cortisol levels at the time of testing were associated with slow working-memory performance at high loads, and with impaired recall of moderately emotional, but not of highly emotional paragraphs. By using the Social Stress Test and assessing salivary cortisol levels, Luethi, Meier and Sandi (2009) also found that working-memory deficit was associated with exposure to stress. A meta-analytic review of the effects of acute cortisol administration, which is released by stress, on human memory concluded that administering cortisol before retrieval reported a significant decrease in memory performance (Het et al., 2005). Studies which administered cortisol before learning found on average no effect. These effects depend on glucocorticoid receptor activation in the hippocampus and concurrent noradrenergic activation in the basolateral amygdale. The latter one seems to be a key structure in a memory-modulatory system that regulates stress and glucocorticoid effects on memory consolidation, memory retrieval and working-memory (Roozendaal, 2002; Roozendaal, Griffith, Buranday, de

Quervain & McGaugh, 2003; Roozendaal, McReynolds & McGaugh, 2004).

EMDR (Eye movement desensitization and reprocessing) involves having a patient imagine a feared scene while he or she is exposed to bilateral sensory stimulation (Barlow, 2004). Working-memory offers a plausible explanation of EMDR effects which is supported by a series of experiments. In a recent series of studies by Gunter and Bodner (2008) examined how eye movements in EMDR treatment produce the benefits that are associated with EMDR: reduction of vividness and emotionality of unpleasant memories. They found that the best way to explain how eye movements produce these benefits is with a working-memory account. When one retrieves an emotional memory while performing another task like horizontal eye movements (or another task that also requires the executive control), the central executive will be taxed. Taxing of the working-memory and simultaneous recalling a memory makes this memory less vivid and emotional and it will be stored in long term memory likewise.

The results of a study by Radomsky and Rachman (2004) showed that patients with OCD had a positive memory bias for information they assumed to be threatening to them, when they were under conditions of high responsibility. They also found that when perceived responsibility increased, confidence in memory decreased. It is assumed here that stress serves as a dual task that taxes working memory, comparable to e.g. eye-movements. The implication is that if memory is retrieved during stress, the recollection will be less vivid and less emotional than when memory is retrieved without stress.

The finding that repeatedly checking within normal people also leads to memory distrust (van den Hout & Kindt, 2003 and 2004), indicates that it makes good sense to study normal (non-clinical) participants in order to draw conclusions about their clinical counterparts. This study tests the hypothesis that confidence in memory decreases in normal participants who repeatedly check the memory while being stressed, compared to control groups who are not stressed. According to earlier results it is also assumed that vividness and detail of the memory decreases. There are no expected effects of mental perseveration on the accuracy of memory.

The hypothesis will be tested in a 2 (recall/no recall) x 2 (stress/ no stress) x 2 (pre- test/post- test) factorial experiment in which stress and mental checking will be systematically manipulated while the effects on confidence, vividness, accuracy and detail of memory will be tested at the pre- and post- test.

2. Methods

2.1 Participants

There were 104 participants, all of them were students. Seven participants were HBO students from the Hogeschool Utrecht, sixty-three studied psychology at the Utrecht University and thirty-four of them followed another study at the same university. Of the participants 24% (25) were male and 76% (79) female. Age ranged from 18 to 46 years old, with a mean age of 21.95 years (SD= 3,245). They received either course credit or a financial reward for their participation. Furthermore, six participants had missing values on the stress- indication at the post- test.

2.2 Pilot study

The pilot study was conducted before the main research in order to check which film and which questions about the film could be used. Three different films were shown to participants. Each participant answered twenty questions about the film he/she saw. The cut-off score for using the questions in the final experiment was above 75 and below 90% rightly answered. When using relatively easy questions, it is plausible to assume that scores on confidence, vividness and detail will be high at the start of the final experiment.

It was decided to use the film which turned out the most suitable, with eight questions falling between the cut-off score (see attachment 1 for the complete questionnaire). The questions were divided in two sets of questions based on the percentage correct. Four questions were used for the first questionnaire (pre- test) and four for the second questionnaire (post- test) about the film. The order of the two sets of questions was randomised for each participant. This resulted in two possible orderings: questions 1, 2, 3 and 4 at the pre- test and questions 5, 6, 7 and 8 at the post- test for the first participant and vice versa for the second participant.

Furthermore, the experiment was piloted with four participants, which were exposed to either a recall- task, a stress- manipulation, both the recall- task and the stress- manipulation, or neither of them.

2.3 Design

We used a 2 (recall/no recall) x 2 (stress/ no stress) x 2 (pre- test/ post- test) mixed design, including between- and within- subjects factors. The participants were randomly

assigned to two different manipulations: a recall- task (yes/no) and a stress- manipulation (yes/no). This makes four conditions (e.g. figure 1). There were 26 participants in the stress- manipulation, 25 got the recall- manipulation alone, 28 got both manipulations and 25 got none of them.

They were also randomly assigned to one of the two different orderings in questions, as mentioned in 2.2 Pilot study.

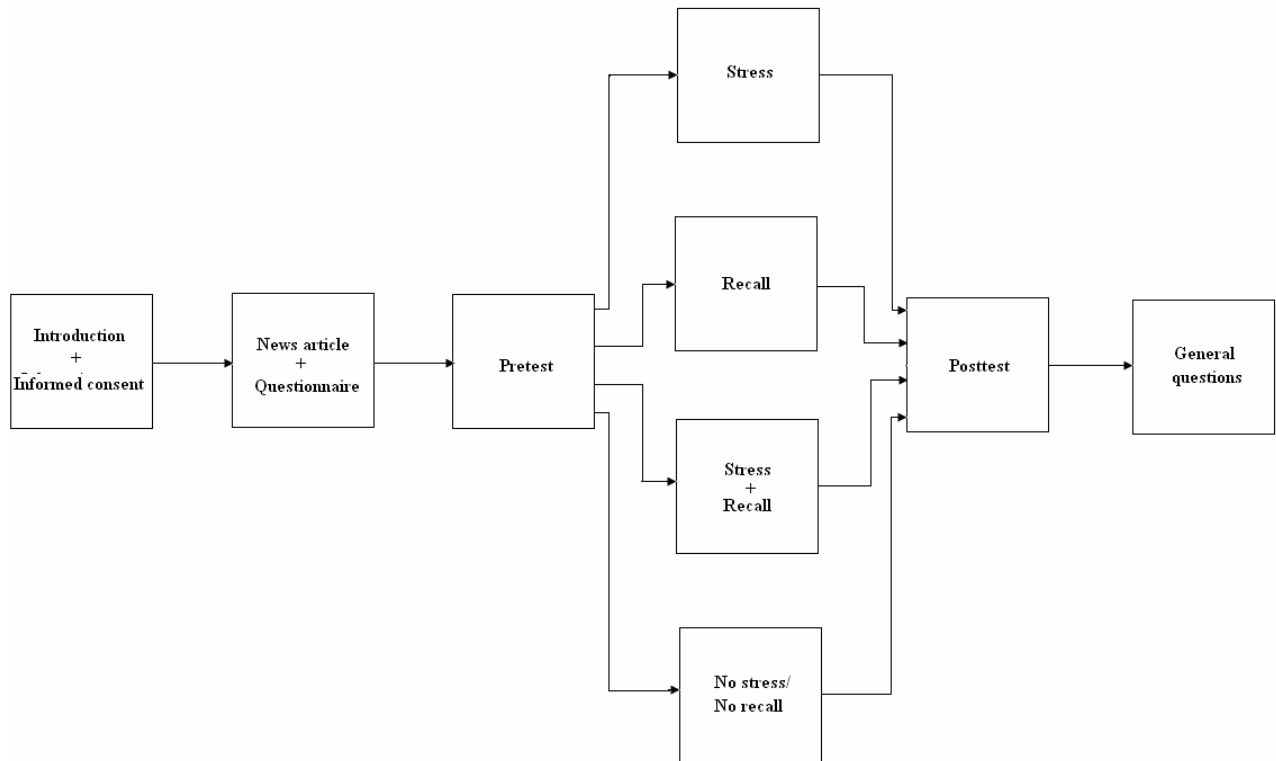


Figure 1: Experimental design.

2.4 Materials

1) Article.

The topic of the article concerned sending Dutch soldiers to Afghanistan. This article was chosen to make the participants believe that this research was about information processing and media.

2) Article- questionnaire.

Questionnaire about the article consisting of five, relatively easy open questions.

3) *Film fragment.*

A film fragment of a traffic situation in which multiple persons cross a road at a traffic light. The length of the film is exactly one minute and three seconds. The theme of this movie (crossing streets) is chosen because it resembles a domain (danger) where obsessive compulsive complaints are developed (Denys & de Geus, 2007).

4) *Stress- questionnaire.*

Questionnaire for measuring the height of stress the participant felt at that very moment. Participants were asked to rate their height of stress while using a 100-mm VAS, ranging from '0' (no stress at all) to '100' (absolutely stressful).

5) *Pre- and post- questionnaire.*

The pre- and post- questionnaire consist each of four questions about the film. These questions were literally answered. At both the pre- and post- test participants were asked to indicate the confidence in their answers, vividness and detail of their recollection of the last question of two 100-mm VAS's running from 'absolutely not confident' to 'extremely confident', 'not detailed' to 'extremely detailed' and from 'not vivid' to 'extremely vivid'. The first four questions were used for the pre- test and the remaining four questions for the post- test (e.g. figure 1). Accuracy was measured by controlling for the right answers on the questions.

6) *Stress manipulation.*

The experimenter put up a tripod and camera slowly, told the participant they would be recorded in the next part and then would be asked difficult, critical questions about the article they read in the first part. They were told that this record of their performance would be shown to a room full of students to see if their performance was positively correlated with how long they studied. This stress manipulation corresponds with the Trier Social Stress Test' (TSST) (Kirschbaum et al., 1993). The TSST consists of a video-taped free speech and a subsequent mental arithmetic task in front of a committee acting with a reserved attitude (Schoofs, Preuß, & Wolf, 2008).

7) *Recall- task.*

The recall task used in this research is based on the recall task from van den Hout, Muris,

Salemink and Kindt (2001) (see attachment 2 for the complete task).

8) *General questionnaire.*

The participants were asked to indicate on a 100-mm VAS ranging from '0' (absolutely not) to '100' (all the time), how much they thought about the film when the experimenter left the room for a certain amount of time (the so called 'breaks'). Also was checked if the students already knew about the experiment from other people and if yes, what did they hear. Furthermore, participants were asked to complete a questionnaire about demographic information (see attachment 1 for all the questions).

2.5 *Procedure*

Participants were randomly assigned to the two different manipulations (recall- task and the stress- manipulation). This resulted in four conditions (e.g. figure 1). There are three experimental conditions, whereby the participant was exposed to the recall- task alone, the stress- manipulation alone, or to both manipulations. In the control condition, the participant was exposed to neither of the manipulations.

Each participant was tested individually and the participants are blind about which condition they are in. They were tested in a dimly lit room where they sat at a desk with a PC in front of them. All the test material (except for the film) was in paper. The experimenter explained that the study aimed at investigating information processing and media. After written informed consent, the first phase of the experiment took place. The four conditions all started with an article about sending Dutch soldiers to Afghanistan. After reading this small article the participants had to answer five relatively easy questions. The article could even be used to answer these five questions. Subsequently the participants saw a short small film which depicts people crossing the street. Hereafter the pre- test took place, whereby the participants rated one question about how much stress they felt at that moment and four questions about the film including VAS's about vividness, detail and confidence per question (e.g. figure 1). Until this point everything was equal for all the participants in the four conditions.

Condition with the recall- manipulation only: In this condition, after answering the first questionnaire about the film fragment, the participants got a one minute during break. The so called 'breaks' are intended to keep the time equal within every condition, because the

manipulations have different durations. The experimenter told the participant she had 'to collect some papers she needed for the next part of the experiment, which were 'so-called' laying in the other research room. When the experimenter came back, the recall task started and took three minutes.

Condition with the stress- manipulation only: Participants in this condition were told they had to answer difficult questions about the article they read at the beginning of the experiment, while being recorded. This would take place at the end of the experiment. They were told that this record of their performance would be shown to a room full of students to see if their performance was positively correlated with how long they have studied. The explanation took one minute, hereafter the experimenter left the room for three minutes. At the end of the experiment the participant did not have to perform the stress- task.

Condition with both the stress- and recall- manipulations. Participants in this condition were given the stress manipulation as well as the recall task. Their break after the stress-manipulation took only ten seconds.

Condition with neither the stress-, nor the recall- manipulation. Participants in this condition did not receive the stress- manipulation, nor the recall- task. There was a four minute during break after they filled in the first questionnaire about the film, whereby they received the same instructions as the participants in the other conditions.

The fourth phase (post- test) of the experiment was equal for each condition: the participants rated a few questions about how much stress they felt at that moment and four questions about the film including VAS's about vividness, detail and confidence per question.

The fifth and last phase of the experiment consisted of general questions. It was stressed that the obtained information was to be kept completely confidential and would be only used for research purposes. The participants were thanked again for their voluntary participation in this study.

2.6 Data- analysis

The data analyse was conducted with SPSS 16.0. A one- way ANOVA was used to compare the demographical differences between the groups. For every participant pre- test results were compared to post- test results. Furthermore, the results on accuracy, confidence in memory and vividness and detail of memory between the conditions were compared. Data

were analysed with mixed (repeated measures) ANOVA's, comparing Time (pre- test versus post- test), Recall (yes/no) and Stress (yes/no) with the former factor being a within-subject factor and the latter two between- subject factors. An ANCOVA was performed to check whether the score on the covariate 'thinking about the film during the break' influences the results.

3. Results

Manipulation check

As expected, at the pre- test the main effects of Recall and Stress on the subjective experienced stress did not reach significance ($F(1, 100) = .409, p = .524$; $F(1, 100) = 1.30, p = .257$). The interaction was also not significant ($F(1, 100) = .069, p = .793$).

At the post- test of experienced stress the main effect of Recall did not reach significance ($F(1, 94) = .996, p = .321$). The main effect of Stress did reach significance ($F(1, 94) = 13.397, p < .01, \eta^2 = .125$). The interaction was not significant ($F(1, 94) = .870, p = .353$).

Overall, a significant effect of Time was found on the experienced subjective stress ($F(1, 94) = 26.132, p < .01, \eta^2 = .218$). There was no significant interaction of Time x Recall ($F(1, 94) = .502, p = .480$). As expected, there was a significant Time x Stress interaction ($F(1, 94) = 33.126, p < .01, \eta^2 = .261$). No significant Time x Recall x Stress interaction was found ($F(1, 94) = 1.117, p = .293$).

This means that there is a significant increase in felt stress within participants who were exposed to the stress- manipulation from pre- test to post- test. The stress- manipulation worked and the recall- task had no additional effect on the experienced stress.

Figure 2 shows the increase of stress within participants who were exposed to the stress- manipulation. See attachment 4 for the ANOVA- tables.

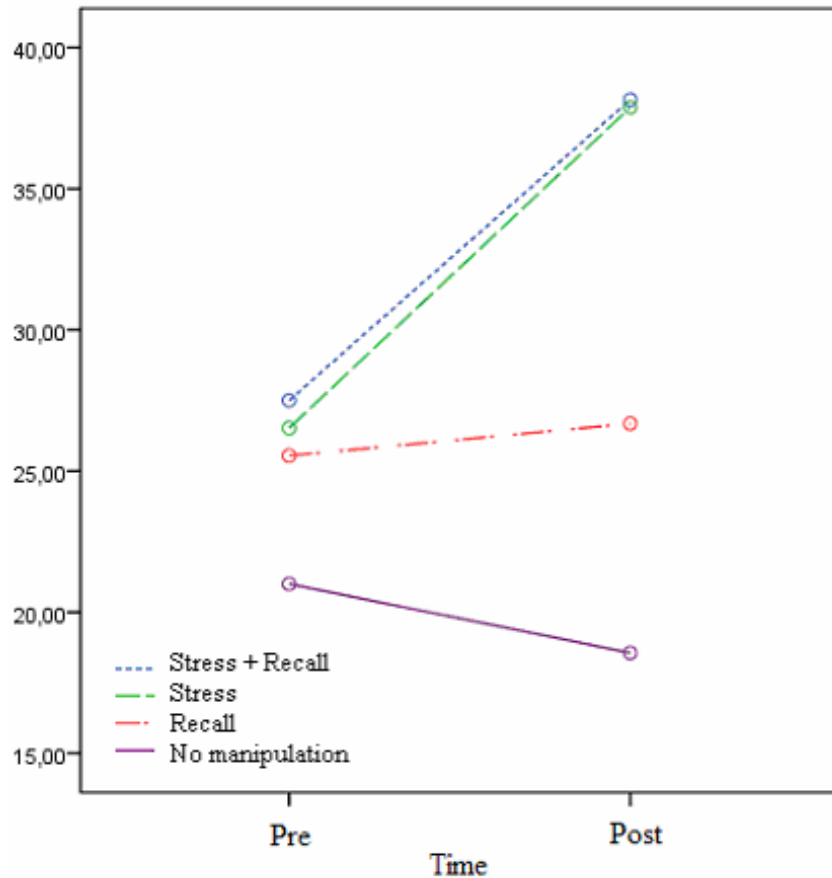


Figure 2: Increases/decreases in stress from the pre- test to the post- test for the different conditions.

Pre- test comparisons

We assumed that the participants show no differences in their scores on confidence, vividness, detail, and accuracy at the pre- test, after being exposed to the different manipulations.

It turned out that there are no main effects of Stress and Recall on confidence ($F(1,100) = .030, p = .862$; $F(1,100) = .010, p = .920$), neither there is a significant interaction ($F(1,100) = .017, p = .896$).

The main effects of Stress and Recall on vividness were not significant ($F(1,100) = .071, p = .790$; $F(1,100) = .0419, p = .839$). There is also no significant interaction of Recall x Stress ($F(1,100) = .166, p = .684$).

For detail, no main effects of Stress and Recall were found ($F(1,100) = .149, p = .700$; $F(1,100) = .007, p = .936$). There was also significant no interaction found ($F(1,100) = .028, p = .868$).

On accuracy, the main effects of Stress and Recall on accuracy as well as the interaction

did not reach significance ($F(1,100) = .005, p = .946$; $F(1,100) = .959, p = .330$; $F(1,100) = .657, p = .420$). See attachment 4 for the ANOVA- tables.

Confidence, detail, vividness, and accuracy for the different groups:

Confidence, detail and, vividness are expected to decline at post- test compared to pre- test when both stress and recall are given and when participants are exposed to stress alone, but the decline will be significant larger for the participants who are both exposed to stress and recall. It is also expected that participants who are exposed to recall alone, will become more confident in memory at the post- test, and have a more vivid and detailed memory compared to the pre- test. For participants who neither were exposed to the recall-task nor the stress-manipulation, no changes are expected for Time. Further was expected that memory accuracy remains unaffected by repeated checking and stress as opposed to confidence in memory.

Unexpectedly for confidence neither the Time effect, nor the Recall effect, nor the Stress effect reached significance ($F(1, 100) = .351, p = .555$; $F(1, 100) = .156, p = .694$; $F(1, 100) = .000, p = .990$). There were also no significant interactions found for Time x Recall as well as Time x Stress and Time x Recall x Stress ($F(1, 100) = .365, p = .547$; $F(1, 100) = .068, p = .794$; $F(1, 100) = .044, p = .834$) (e.g. figure 3).

For vividness the main effects for Time, Recall and Stress was also not significant ($F(1, 100) = 1.056, p = .307$; $F(1, 100) = .015, p = .904$; $F(1, 100) = .001, p = .980$). Neither the Time x Recall interaction, nor the Time x Stress and the Time x Recall x Stress interactions were significant ($F(1, 100) = .231, p = .632$; $F(1, 100) = .0163, p = .687$; $F(1, 100) = .042, p = .839$) (e.g. figure 4).

There were also no significant effects found for detail on Time, Recall and Stress ($F(1, 100) = .007, p = .932$; $F(1, 100) = .130, p = .720$; $F(1, 100) = .308, p = .580$). The interactions Time x Recall, the Time x Stress and the Time x Recall x Stress were not significant ($F(1, 100) = .292, p = .590$; $F(1, 100) = .001, p = .974$; $F(1, 100) = .021, p = .886$) (e.g. figure 5).

On accuracy a significant effect was found for Time, $F(1, 100) = 9.594, p < .01, \eta^2 = .088$. There is a decline in accuracy; participants tend to make more mistakes on the post- test compared to the pre- test. No significant effects were found for the main effects Recall and Stress ($F(1, 100) = .901, p = .345$; $F(1, 100) = .044, p = .835$). Also, there were no significant interactions: Time x Recall, $F(1, 100) = .124, p = .725$; Time x Stress, $F(1,$

100) = .087, $p = .768$; and the Time x Recall x Stress $F(1, 100) = .042, p = .838$ (e.g. figure 6).

After controlling with ANCOVA's for the factor 'thinking about the film during the break', none of the results changed.

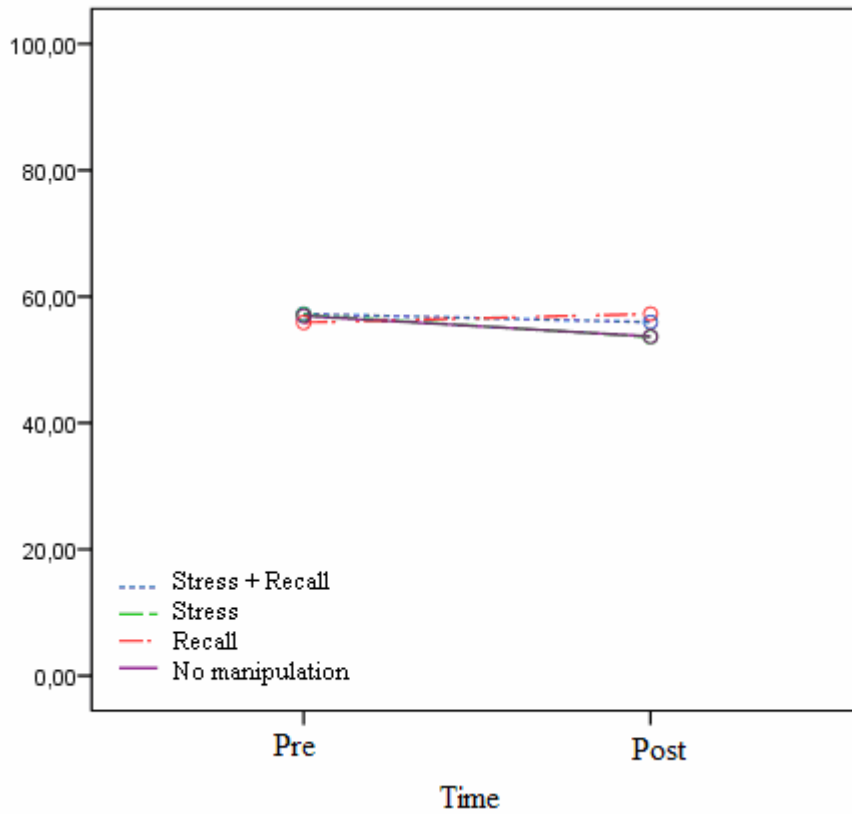


Figure 3: Confidence, at the pre- and post- test for the different stress and recall manipulations.

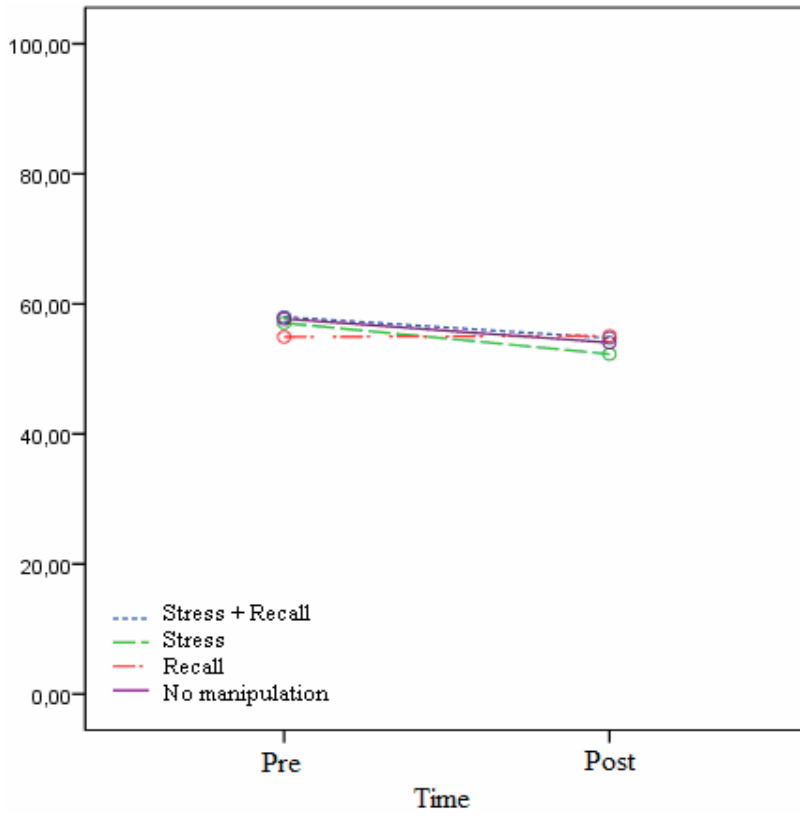


Figure 4: Vividness, at the pre- and post- test for the different stress and recall manipulations.

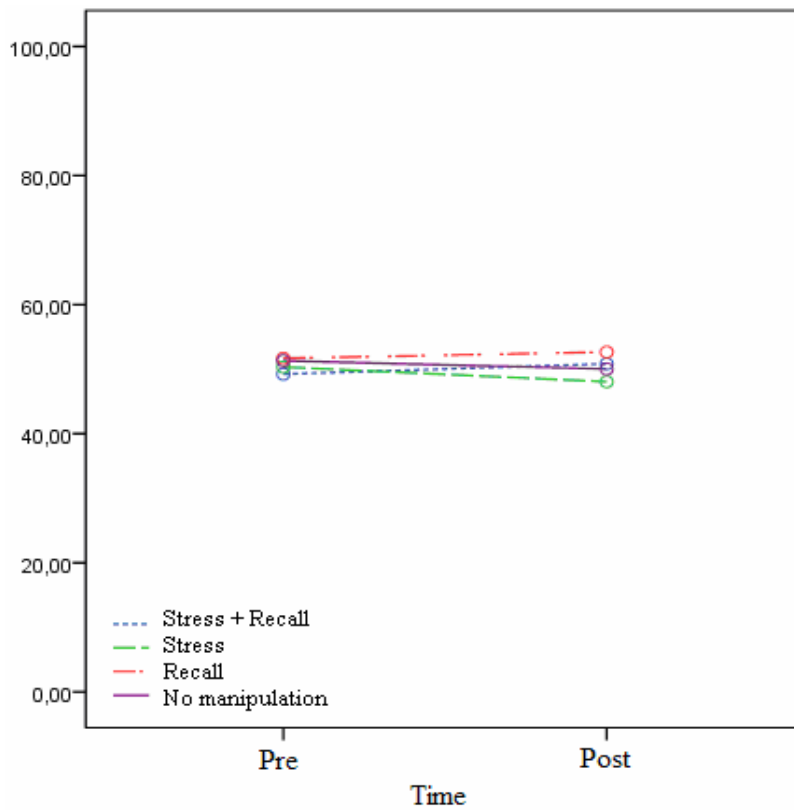


Figure 5: Detail, at the pre- and post- test for the different stress and recall manipulations.

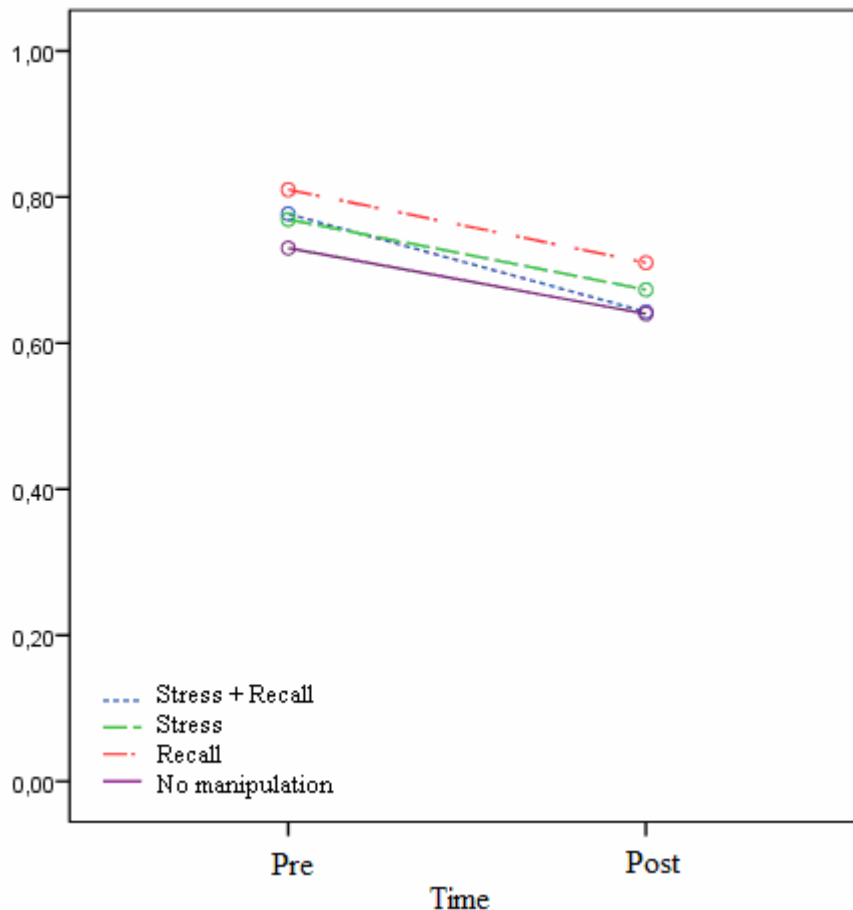


Figure 6: Accuracy, at the pre- and post- test for the different stress and recall manipulations.

4. Discussion

The topic of our research was whether repeated checking in normal participants during anxious anticipation would cause uncertainty. Multiple research results show that confidence, detail and vividness decline with repeated physical checking. We conjectured that this will happen with mental checking as well.

Our study did not replicate the finding of previous authors that repeated checking is associated with memory distrust and that this is linked with reduced vividness and detail of the checked memory (Radomsky et al., 2006; van den Hout & Kindt, 2003, 2004). For no manipulation were differences between the pre- test and the post- test on confidence, detail and vividness found. Since confidence correlates with detail and vividness of memory (van den Hout & Kindt, 2003, 2004), it is highly probable that when confidence is not changing, neither will detail and vividness.

With the expiration of time, participants became less accurate. This is a normal decay of

memory over time (Wixted, 2004). As expected, the mental perseveration had no additive effects on the accuracy of memory. The stress- manipulation inferred by the TSST (Kirschbaum et al., 1993) worked. The participants who were exposed to this manipulation experienced significant more stress at the post- test, compared to participants who did not underwent the stress- manipulation.

It was expected that distrust in memory would increase. Possible explanations for the absence of the reduction in memory confidence, detail and vividness could be due to limitations concerning 1) deficits in the quantity and quality of the questions, 2) the quality, place and content of the film, 3) the recall- task and the way in which mental checks were performed and 4) the taxed amount of the working- memory.

First of all the validity of certain questions relating to the film is in doubt, because they could be guessed. For example, the question about the colour of a plastic bag could be guessed with no confidence at all, because the right answer was white, which is often the case. Questions that will be used in future research need to be constructed in a way that the answers cannot easily be guessed. This can be realised by using more extended answer possibilities. It is also possible that the pre- and post- test contained too few questions. Maybe with ten questions each for example, the questionnaires would become more valid and reliable. On the other hand, with so many questions the focus on the questionnaire could decrease through boredom for filling in the same VAS's over and over again. To guarantee that the questions themselves are valid and reliable, a larger pilot- study should be carried out, whereby more questions and more participants are used.

The final idea for further research regarding the questions is that the difference between vividness and detail is possibly not clear. Some participants told the experimenter afterwards the experiment that they did not know the difference between these two constructs.

The second issue concerns the quality, place and content of the film, which were moderate. At some moments the images were less bright. However, this had little or no effect on the accuracy in answering the questions. These were answered quite well, but the moderate quality could have affected the participants' answers on confidence, detail and vividness, because the participants could have remembered the answer but were not capable to form the image vivid and detailed enough in their mind, which can lead to uncertainty.

The film was recorded with a photo camera with 5.2 mega- pixels. A better option would be using a video- camera instead of a photo camera. The picture of the film then becomes more

vivid and clear.

A related question concerns the knowledge of the participant of the place where the film was taken. The film was recorded near to a mall in Utrecht and this place might be known to the participants. Instead of remembering some details of the film, they could know the answer and therefore had a more detailed and vivid picture of it in their mind. A better option is recording the film abroad or somewhere at a road with few recognisable aspects.

A related issue concerns the content of the film. Obsessive compulsive complaints are developed in a specific domain where the development of confidence is (almost) never possible and where chances for losing control are high. These domains are sexuality, disease, danger, death and love (Denys & de Geus, 2007, pp.32-33). Possibly traffic is a domain which is not of personal relevance to the students, in contrast to OCD- patients. People who are crossing the street can be interpreted as dangerous within an OCD- sample, but not for the student- sample.

To make sure that the results can be generalised to the OCD-population and to make future studies more realistic, also a higher sense of personal responsibility should be manipulated. The recurrence of the checking is promoted by the sense of responsibility (Rachman, 2002). Repeated checking may cause memory distrust and this effect is enhanced when individuals are checking something for which they feel responsible. This manipulation is performed in earlier studies (Boschen & Vuksanovic, 2007).

Regarding the recall- task, participants were supposed to be rehearsing the same part of the film (e.g. the people crossing the street). We assumed that this would work with the global task 'recall when the people crossed the street', but it is uncertain whether the participants rehearsed the same part of the 30 seconds of the film fragment every time they had to perform a mental check of 15 seconds. It can not be excluded that they recalled different parts of the movie during every 'mental check'. An implication could be that this does not resemble mental checking as OCD patients do. In future research the instructions need to be more specific about which explicit part of the film should to be rehearsed.

Unfortunately it was not possible to use a sound- dense setting in this experiment. This setting should be used in follow- up studies to make sure the participants are not distracted by the noise outside.

A question mark can be placed by the assumption that even a few checks corrupt memory confidence, detail and vividness (Hermans et al., 2008). Coles et al. (2006) indicated that 2 to

10 times checking is enough to show memory distrust, but most other studies used about 20 checking trials, (Hermans et al., 2008). Perhaps more checking is necessary for mental checking to have an effect. Boschen and Vuksanovic (2007) found that just after ten checks there was a significant effect of decline in confidence, in our study participants had to check only four times. Hence, it can be predicted that with an increasing number of checks, a reduction in memory confidence, detail and vividness would have been observed since more checking leads to more uncertainty (van den Hout and Kindt, 2003).

It could also be argued the participants carried out the recall task incorrectly, or did not fully understand how to perform a mental check. This is consistent with their comments about the recall- task. A practice trial could be required to make the participants familiar with mental checking.

A fourth limitation could be that the working- memory is taxed too little during the recall-task. The stress- manipulation worked, but it could be that the cut- off score for stress, for having a negative effect on the working- memory, is much higher than in our research. It is important that enough stress is induced, because checking compulsions in OCD patients tend to be accompanied by tension and/or anxiety (Rachman, 2002). Perhaps OCD patients experience far more stress and with a higher cut-off score, the working- memory would be more taxed. It is not justified to heighten stress during an experiment, a simultaneous reaction task can be used in follow- up studies to solve this problem.

In addition of the possible limitations concerning our methods, there is still some ambiguity about the definition of mental checking. The EMDR- theory we described earlier (where the working-memory is taxed and a memory is simultaneous recalled, this memory will be less vivid and emotional) would be the first explanation why mental checking leads to memory distrust. Unfortunately this reciprocal relation was not found in this research. Mental checking could be defined as the repeated retrieval of memories of a part of a scenario (visualisation), but this is not well investigated.

For further research it would be interesting to focus on the definition of mental checking. If the definition remains as it is today (vague and undefined), valid and reliable research cannot be carried out. More diagnostic interviews could be used to give more insight to the meaning of mental checking. However mental actions or thoughts always stay a subjective domain and therefore difficult to investigate.

Few studies investigated mental checking (Schalekamp & Blondé, 2008). It is possible that there is no relationship between mental checking and memory distrust, as this study indicated, in contrast to the existing relationship between physical checking and memory distrust (Van den Hout and Kindt, 2003; 2004; Hermans et al., 2008). Future studies need to consider the methodological limitations and revise the definition of mental checking, so that the relationship between mental checking and memory distrust can be investigated in a more valid and reliable manner.

6. Conclusions

It can be concluded that our study did not replicate the results of previous authors that repeated checking is associated with memory distrust. Earlier research considered physical checking and this study investigated mental checking. It is quite certain that with the expiration of time participants became less accurate. This can be considered as a normal decay of memory over time. It can be stated with great certainty that the stress- manipulation worked, less certain is whether the induced stress is high enough to tax the working memory. Possibly mental checking is not sufficiently defined. Resolution of this is required before more research can be done to investigate mental checking and the effects of mental checking on confidence, detail and vividness.

7. Acknowledgements

We would like to thank Prof. M.A. van den Hout and C. L. Giele MSc. for supervising and correcting us in our writing and analysing. Also thanks to E.C.P. Dek, MSc. and M. Lommen, MSc. for new creative ideas and support and to drs. D. Hamer and drs. E. Bos for correcting the English grammar.

References

- Ashcraft, M. H. (2002). *Cognition*. New Jersey: Prentice Hall.
- Baddeley, A. (2003). Working memory: looking back and looking forward. *Nature reviews neuroscience*, 4, 829-839.
- Boschen J. M., & Vuksanovic, D. (2007). Deteriorating memory confidence, responsibility perceptions and repeated checking: Comparisons in OCD and control samples. *Behaviour research and therapy*, 45, 2098-2109.
- Buchanan, T. W., Tranel, D., & Adolphs, R. (2006). Impaired memory retrieval correlates with individual differences in cortisol response but not autonomic response. *Learning and memory*, 13, 382-387.
- Christensen, K. J, Kim, S. W., Dysken, M. W., & Hoover, K. M. (1992). Neuropsychological performance in obsessive-compulsive disorder. *Biological Psychiatry*, 31, 4-18.
- Coles, M.E., Radomsky, A.S., & Horng, B. (2006). Exploring the boundaries of memory distrust from repeated checking: Increasing external validity and examining thresholds. *Behaviour Research & Therapy*, 44, 995-1006.
- Dar, R. (2004). Elucidating the mechanism of uncertainty and doubt in obsessive-compulsive checkers. *Journal of behaviour therapy and experimental psychiatry*, 5, 153-163.
- Denys, D., & de Geus, F. (2007). *Handboek obsessieve-compulsieve stoornissen*. Utrecht: De Tijdstroom.
- Hermans, D., Engelen, U., Grouwels, L., Joos, E., Jos Lemmens, J., & Pieters, G. (2008). Cognitive confidence in obsessive-compulsive disorder: Distrusting perception, attention and memory. *Behaviour research and therapy*, 46, 98-113.
- Het, S., Ramlow, G., and Wolf, O.T. (2005). A meta-analytic review of the effects of acute cortisol administration on human memory. *Psychoneuroendocrinology* 30, 771-784.
- Hout, M., van den, & Kindt, M (2003). Repeated checking cause memory distrust. *Behaviour research and therapy*, 41, 301-316.
- Hout, M., van den, & Kindt, M. (2004). Obsessive-compulsive disorder and the paradoxical effects of perseverative behaviour on experienced uncertainty. *Journal of behaviour therapy and experimental psychiatry*, 35, 165-181.
- Hout, M., van den, Muris, P., Salemink, E., & Kindt, M. (2001). Autobiographical memories

- become less vivid and emotional after eye movements. *British Journal of Clinical Psychology*, 40, 121-130.
- Karpicke, J. D., & Roediger, H. L. (2006). Repeated retrieval during learning is the key to long-term retention. *Journal of memory and language*, 57, 151-162.
- 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.
- Kuhlmann, S., Kirschbaum, C., & Wolf, O. T. (2005). Effects of oral cortisol treatment in healthy young women on memory retrieval of negative and neutral words. *Neurobiology of learning and memory*, 83, 158-162.
- Luethi, M., Meier, B., & Sandi, C. (2009). Stress effects on working memory, explicit memory, and implicit memory for neutral and emotional stimuli in healthy men. *Frontiers in Behavioral Neuroscience*, 2.
- Lupien, S. J., Gillin, C. J., & Hauger, R. L. (1999). Working memory is more sensitive than declarative memory to the acute effects of corticosteroids: a dose-response study in humans. *Behavioral Neuroscience*, 113, 420-430.
- Moritz, S., Jacobsen, D., Willenborg, B., Jelinek, L., & Fricke, S. (2006). A check on the memory deficit hypothesis of obsessive-compulsive checking. *European archives of psychiatry clinical neuroscience*, 256, 82-86.
- Moritz, S., Ruhe, C., Jelinek, L., & Naber, D. (2009). No deficits in nonverbal memory, metamemory and internal as well as external source memory in obsessive-compulsive disorder (OCD). *Behaviour research and therapy*, 47, 308-315.
- Muller, J., & Roberts, J. E. (2005). Memory and attention in obsessive-compulsive disorder: a review. *Anxiety disorders*, 19, 1-28.
- Nedeljkovic, M., & Kyrios, M. (2007). Confidence in memory and other cognitive processes in obsessive-compulsive disorder. *Behaviour research and therapy*, 45, 2899-2914.
- Oei, N. Y., Everaerd, W. T., 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, 133-141.
- Radomsky, A.S., Rachman, S., & Hammond, D. (2001). Memory bias, confidence and responsibility in compulsive checking. *Behaviour research and therapy*, 39, 813-822.
- Radomsky, A. S., & Rachman, S. (2004). The importance of importance in OCD memory research. *Journal of behavior therapy and experimental psychiatry*, 35, 137-151.

- Radomsky, A. S., Gilchrist, P. T., & Dussault, D. (2006). Repeated checking really does cause memory distrust. *Behaviour research and therapy*, *44*, 305-316.
- Rassin, E., Cougle, J. R., & Peter Muris (2007). Content difference between normal and abnormal obsessions. *Behaviour research and therapy*, *45*, 2800-2803.
- Repovs, G., & Baddely, A. (2006). The multi-component model of working memory: explorations in experimental cognitive psychology. *Neuroscience*, *139*, 5-21.
- Roozendaal, B. (2002). Stress and memory: opposing effects of glucocorticoids on memory consolidation and memory retrieval. *Neurobiology of learning and memory*, *78*, 578-595.
- Roozendaal, B., Griffith, Q. K., Buranday, J, de Quervain, D. J. & McGaug, J. L. (2003). The hippocampus mediates glucocorticoid-induced impairment of spatial memory retrieval: dependence on the basolateral amygdala. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, *100*, 1328-1333.
- Roozendaal, B., McReynolds, J. R. & McGaugh, J. L. (2004). The basolateral amygdala interacts with the medial prefrontal cortex in regulating glucocorticoid effects on working memory impairment, *Journal of neuroscience*, *24*, 1385-1392.
- Schalekamp, B., & Blondé, A. (2008). *Mental checking and the influence on memory confidence*. Unpublished doctoral dissertation, Utrecht University, Utrecht.
- Tops, M., van der Pompe, G., Wijers, A. A., Den Boer, J.A., Meijman, T. F., & Korf, J. (2004). Free recall of pleasant words from recency positions is especially sensitive to acute administration of cortisol. *Psychoneuroendocrinology*, *29*, 327-338.
- Van der Wee, N., Jansma, M., van Megen, H., Westenberg, H., Kahn, R. S., & Ramsey, N. (2001). Reduced efficacy of the spatial working memory system in obsessive compulsive disorder. *NeuroImage*, *13*, 1109.
- Wixted, J. (2004). The psychology and neuroscience of forgetting. *Annual Review of Psychology*, *55*, 235-269.
- Wolf, O.T., Convit, A., McHugh, P.F., Kandil, E., Thorn, E.L., de Santi, S., McEwen, B.S., & de Leon, M.J. (2001). Cortisol differentially affects memory in young and elderly men. *Behavioral neuroscience*, *115*, 1002-1011.
- Young, A. H., Sahakian, B. J., Robbins, T. W., & Cowen, P. J. (1999). The effects of chronic administration of hydrocortisone on cognitive function in normal male volunteers. *Psychopharmacology*, *145*, 260-266.
- Zitterl, W., Urban, C., Linzmayer, L., Aigner, M., Demal, U., Semler, B., & Zitterl-Eglseer, K. (2001). Memory deficits in patients with DSM-IV obsessive-compulsive disorder.

Psychopathology, 34, 113-117.

Attachment 1: Informed consent



Universiteit Utrecht

Beste participant,

Als vierdejaars klinische- en gezondheidspsychologie studenten aan de Universiteit van Utrecht zijn wij voor ons afstuderen bezig met een Masteronderzoek.

We zouden het erg op prijs stellen als u aan dit onderzoek zou willen deelnemen. Wanneer u instemt met deelname, wordt u gevraagd een artikel te lezen, een aantal vragen te beantwoorden, een filmfragment te bekijken en een taak uit te voeren. Het onderzoek zal ongeveer dertig minuten gaan duren en na afloop zal het doel ervan duidelijk uitgelegd worden en worden eventuele vragen beantwoord.

Binnen dit onderzoek richten wij ons op studenten tussen de 18 en 30 jaar. Als u niet tot deze leeftijdscategorie behoort, hoeft u niet aan dit onderzoek deel te nemen.

De verzamelde gegevens worden vertrouwelijk behandeld. De gegevens zullen anoniem geanalyseerd worden. Het is absoluut geen "eng" psychologisch onderzoek, waarbij de participanten binnenste buiten worden gekeerd. Ons onderzoek is namelijk alleen gericht op informatieverwerking bij media.

Alvast onze hartelijke dank voor uw deelname.

Mocht u nog vragen hebben over dit onderzoek, neem dan contact op met één van de onderzoekers:

S. Kwakernaak,
E.A.C. Andeweg,

S.Kwakernaak@students.uu.nl
E.A.C.Andeweg@students.uu.nl

Informed Consent

Ik, _____, verklaar dat ik tussen de 18 en de 30 jaar oud ben en dat ik toestemming verleen om deel te nemen aan dit Psychologie onderzoek. Ik bevestig dat ik door E.A.C. Andeweg/ S.Kwakernaak ben geïnformeerd en dat mijn deelname aan deze studie vrijwillig is, dat ik op ieder moment de deelname kan beëindigen, en dat alle datagegevens die ik geef vertrouwelijk behandeld zullen worden. Ik weet dat ik na afloop van het onderzoek een uitleg zal krijgen over het doel van het onderzoek. Ik begrijp dat deelname aan dit onderzoek geen negatieve gevolgen voor mij zal hebben.

Handtekening participant

Datum

Na afloop van het onderzoek heb ik een volledige uitleg over het doel van het onderzoek en zijn de mogelijke vragen die ik had volledig beantwoord. Tevens vertrek ik geen informatie aan andere studenten over dit onderzoek.

Handtekening participant

Datum

Als u na afloop van het gehele onderzoek informatie wilt ontvangen over de uitkomsten hiervan, schrijf dan uw emailadres hieronder:

Attachment 2: Used questionnaires

Respondentnummer

(in te vullen door de proefleider)



Universiteit Utrecht

Faculteit Sociale Wetenschappen

Heidelberglaan 1

3584 CS Utrecht

030-2534700

Respondentnummer
(in te vullen door de proefleider)

Lees onderstaand krantenartikel:

Nederland definitief tot 2010 in Uruzgan

De Nederlandse bijdrage aan de NAVO-missie in Afghanistan wordt verlengd tot 2010. De betrokken ministers zijn het hierover eens geworden.



De missie zal duren tot 2010. Er zullen twee tot driehonderd militairen worden teruggetrokken. Ook twee van de zes F-16's keren terug naar Nederland. De vijf Apaches blijven wel. Premier Jan Peter Balkenende (CDA) heeft onderstreept dat het Nederlandse leger 'hun leidende rol' in Uruzgan op 1 augustus 2010 sowieso beëindigen.

Vrijwel de gehele oppositie is tegen het kabinetsbesluit. Alleen de SGP is een voorstander. De VVD wil nog niet beloven de verlenging te steunen. VVD'er Hans van Baalen wil eerst meer weten over de financiering van de missie.

Uitgaven

Gisteren werd al bekend dat het kabinet 1 miljard euro voor de verlenging van de missie heeft gereserveerd: de uitgaven worden geraamd op jaarlijks ongeveer 355 miljoen euro. Daarnaast is er een potje 'onvoorziene kosten' van 132 miljoen euro per jaar in de begroting opgenomen.

Het besluit tot verlenging heeft lang op zich laten wachten: verschillende NAVO-bondgenoten en de Afghaanse regering dringen al langer aan op een verlengde verblijf van de Nederlandse militairen - bijna 1.700 in totaal - in het land.

-----Ga naar de volgende pagina-----

Respondentnummer
(in te vullen door de proefleider)

Toezeggingen

Nederland had afgesproken tot de zomer van volgend jaar te blijven. Daarna zouden de taken door andere NAVO-landen worden overgenomen.

Maar die toonden tijdens de NAVO-top vorige maand in Noordwijk weinig bereidheid daartoe: alleen Frankrijk, Tsjechië, Slowakije, Georgië en Hongarije deden kleine toezeggingen.

Publieke opinie: Een meerderheid van de Nederlanders vindt dat de militaire missie in Afghanistan niet moet worden verlengd.

Ook als de nieuwe president van de Verenigde Staten, Barack Obama, in 2010 vraagt of 'we' in de provincie Uruzgan willen blijven, is het antwoord van 54 procent van de Nederlanders "nee".

Iets meer dan een kwart (27 procent) wil wel tegemoet komen aan een dergelijke wens. Dit bleek vrijdag uit een peiling van Maurice de Hond onder meer dan 1200 mensen.

-----Ga naar de volgende pagina-----

Vragenlijst 1

Respondentnummer
(in te vullen door de proefleider)

Beantwoord onderstaande vragen over het krantenartikel, het is belangrijk dat je ze allemaal invult.

1. Tot welk jaartal wordt de bijdrage aan de NAVO- missie in Afghanistan verlengd?

.....
.....

2. Hoeveel euro was er gereserveerd voor de missie in Urugzan door ons kabinet?

.....
.....

3. Nederland had afgesproken tot de zomer 2008 te blijven. Daarna zouden de taken door andere NAVO-landen worden overgenomen. Noem één van de landen die een kleine toezegging deden?

.....
.....

4. Wat vinden de meeste Nederlanders van een verlenging van de militaire missie in Afghanistan?

.....
.....

5. Geef een schatting van de hoeveelheid Nederlandse militairen die teruggetrokken worden uit Afghanistan.

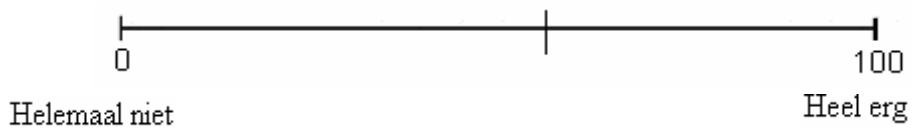
.....
.....

Haal nu de proefleider

Respondentnummer
(in te vullen door de proefleider)

Er zal je zo gevraagd worden een aantal antwoorden te geven middels een vas-lijn. Dit kun je doen door een verticale streep op deze lijn te zetten bij het antwoord dat het beste bij je past. 0 betekent 'helemaal niet', 100 betekent 'helemaal wel'.

Hier volgt een voorbeeld:



Geef nu aan hoe gespannen je op dit moment bent



-----Ga naar de volgende pagina-----

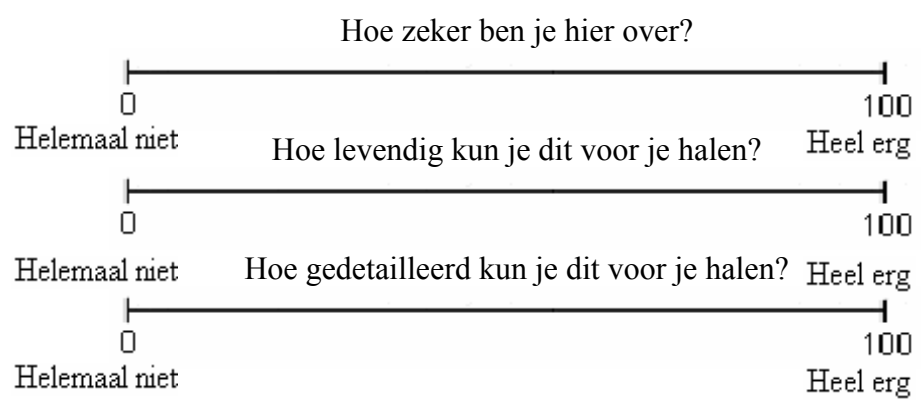
Vragenlijst 2

Respondentnummer
(in te vullen door de proefleider)

Hier volgen een aantal vragen over de film die je zojuist hebt gezien. Het is belangrijk dat je ze allemaal invult.

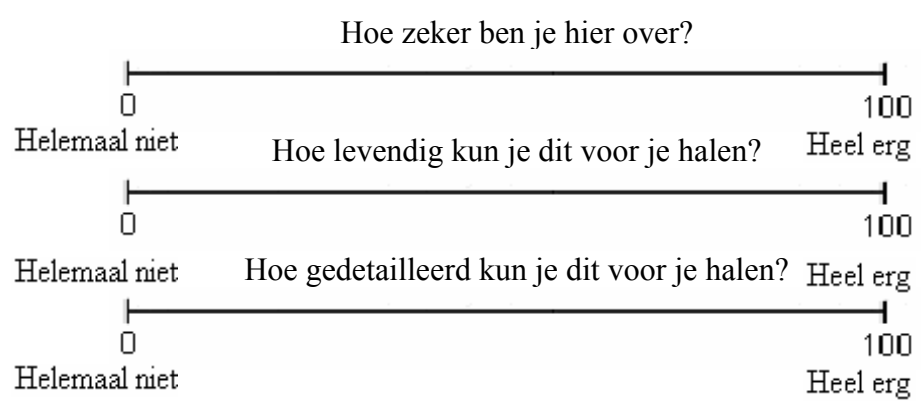
1. Wat is de kleur van de jas van de persoon die rechts naast de eerst- wachtende persoon gaat staan (met de rug naar je toe)?

.....



2. Wat is de kleur haar van de persoon die als eerst bij het stoplicht staat te wachten?

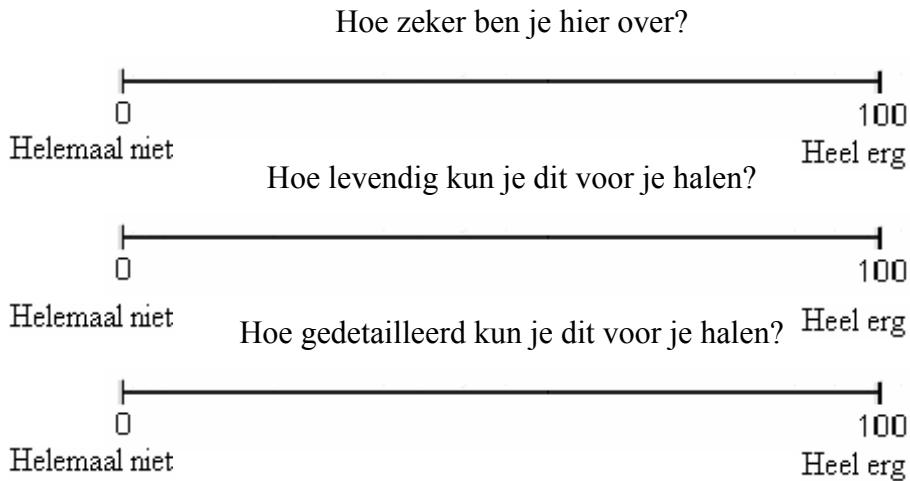
.....



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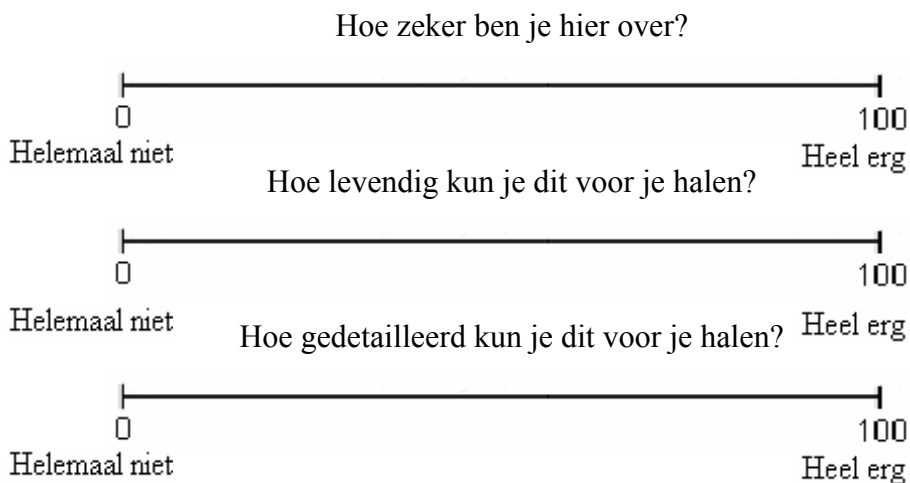
3. Wat is de kleur van de plastic tas van de perso(o)n(en) die aan de overzijde van de weg staat/staan en lopend gaat/gaan oversteken?

.....



4. Hoeveel mannen steken lopend over?

.....



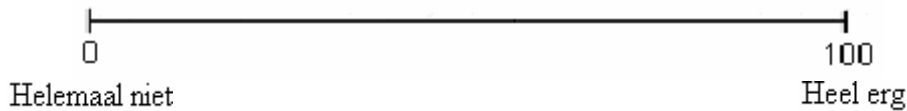
Haal nu de proefleider

Vragenlijst 3

Respondentnummer

(in te vullen door de proefleider)

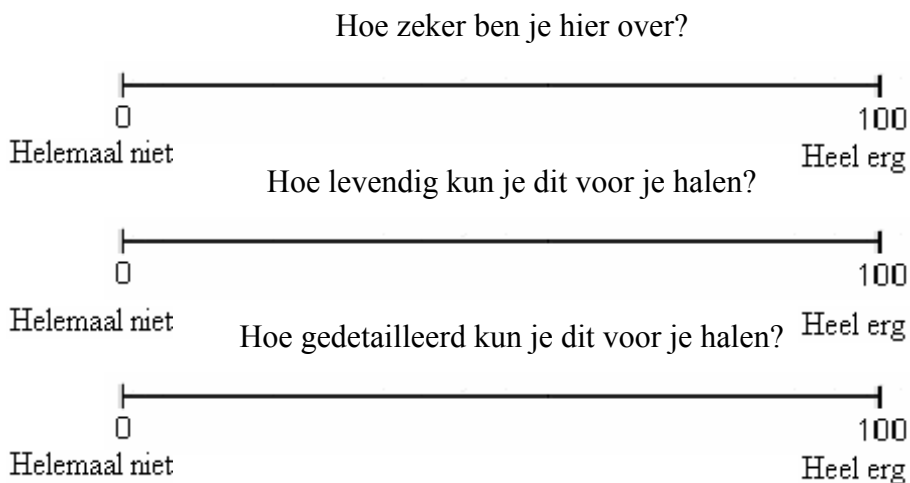
Hoe gespannen ben je op dit moment? Geef dit met een verticale streep aan op deze schaal (0= totaal niet gespannen, en 100=heel erg gespannen):



Hier volgen weer een aantal vragen over de film die je hebt gezien. Het is belangrijk dat je ze allemaal invult.

1. Wat is de kleur van de bus die het eerst afslaat?

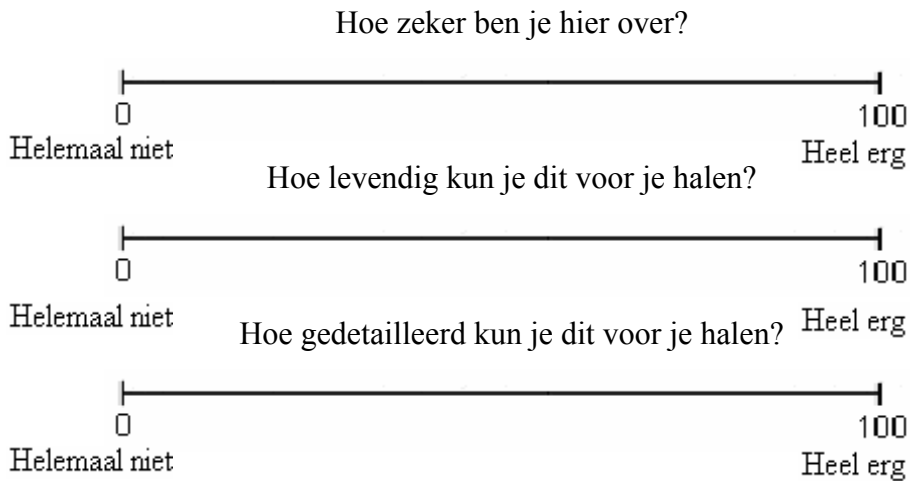
.....



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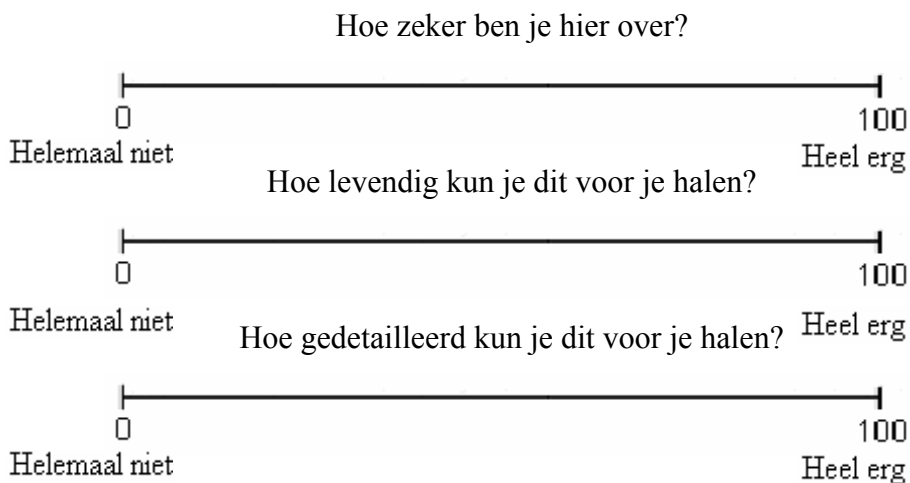
2. Wat is het eerste woord dat op het gebouw aan de overzijde staat?

.....



3. Wat is de kleur jas van de persoon die als eerst bij het stoplicht staat te wachten?

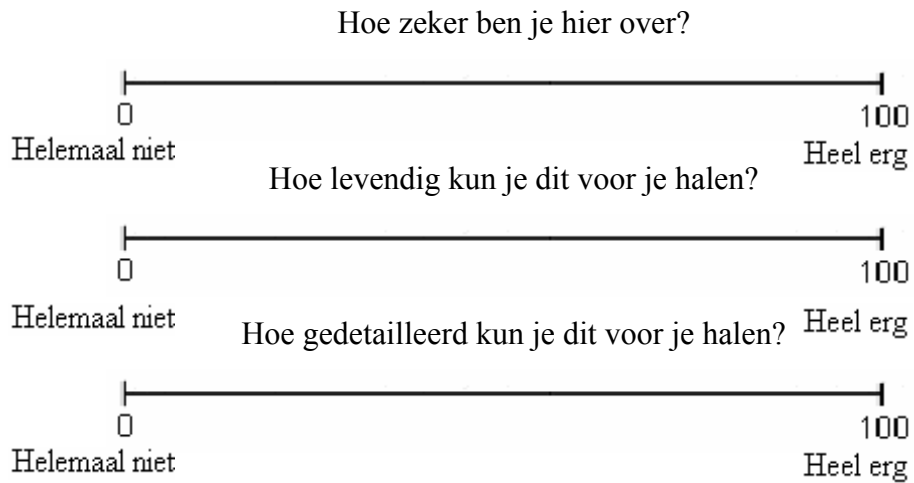
.....



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4. Wat is het geslacht van de persoon die als eerst bij het stoplicht staat te wachten?

.....



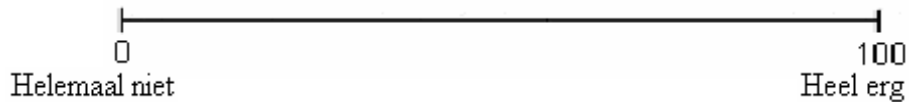
Haal nu de proefleider

Vragenlijst 4

Respondentnummer
(in te vullen door de proefleider)

Tot slot willen wij graag nog enkele gegevens weten:

Je hebt een tijdje niets gedaan nadat je de eerste keer vragen over de film beantwoordt hebt en proefleider papieren ging halen voor het volgende onderzoeksdeel. In hoeverre heb je op dat moment aan de film gedacht?



Heb je al van dit onderzoek gehoord van andere studenten? Ja Nee

Zo ja, wat werd er verteld?:

.....
.....
.....
.....
.....

Geslacht: Man Vrouw

Moedertaal:

Leeftijd: jaar

Opleiding:

Bedankt voor je deelname!
Je kunt je melden bij de proefleider

Attachment 3: Recall task

‘Ik ga je dadelijk vragen om een herinnering op te halen. Denk nu terug aan de tijd dat de mensen de straat overstaken. Houd je ogen open en probeer die tijd te herinneren. Vorm een beeld van de gebeurtenis. Denk aan waar het gebeurde, wie erbij waren, wat je voelde en al het andere dat je kunt zien. Breng de gebeurtenis zo levendig mogelijk in gedachten, alsof het nu aan het gebeuren is. Geef me een teken als je de gebeurtenis zo goed mogelijk voor je hebt?’ Wanneer het teken wordt gegeven zegt de proefleider: ‘begin nu.’ Vanaf dit moment gaan de vijftien seconden in. Wanneer de vijftien seconden voorbij zijn, meldt de proefleider: ‘de tijd is om je kunt even rusten’. Het rusten duurt tien seconden. Na het rusten wordt de participant gevraagd weer sterk aan het moment te denken dat de personen in de film de straat oversteken, wat weer vijftien seconden duurt. Dit wordt gevolgd door tien seconden rust. In totaal wordt de participant vier maal vijftien seconden lang gevraagd aan de film terug te denken, wat telkens afgewisseld wordt met tien seconden rust.

Attachment 4: ANOVA's

Stress- manipulation:

Experienced stress at the pre- test for the recall and stress- manipulation:

Descriptive Statistics

Dependent Variable:pre test gespannenheid

RecallJ AofNEE	StressJ AofNEE	Mean	Std. Deviation	N
niet	niet	21,0000	16,23012	25
	wel	26,0385	18,63434	26
	Total	23,5686	17,50800	51
wel	niet	24,2400	20,65042	25
	wel	27,3929	17,46603	28
	Total	25,9057	18,91404	53
Total	niet	22,6200	18,45446	50
	wel	26,7407	17,87924	54
	Total	24,7596	18,18753	104

Tests of Between-Subjects Effects

Dependent Variable:pre test gespannenheid

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	596,790 ^a	3	198,930	,594	,620	,018
Intercept	63148,870	1	63148,870	188,649	,000	,654
RecallJAofNEE	136,912	1	136,912	,409	,524	,004
StressJAofNEE	435,202	1	435,202	1,300	,257	,013
RecallJAofNEE * StressJAofNEE	23,061	1	23,061	,069	,793	,001
Error	33474,200	100	334,742			
Total	97827,000	104				
Corrected Total	34070,990	103				

a. R Squared = ,018 (Adjusted R Squared = -,012)

Experienced stress at the post- test for the recall and stress- manipulation:

Descriptive Statistics

Dependent Variable:post test gespannenheid

RecallJ AofNEE	StressJ AofNEE	Mean	Std. Deviation	N
niet	niet	18,5600	16,55818	25
	wel	37,8800	23,38326	25
	Total	28,2200	22,30063	50
wel	niet	26,6818	21,31261	22
	wel	38,1538	21,30107	26
	Total	32,8958	21,85566	48
Total	niet	22,3617	19,16227	47
	wel	38,0196	22,12102	51
	Total	30,5102	22,09504	98

Tests of Between-Subjects Effects

Dependent Variable:post test gespannenheid

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6769,532 ^a	3	2256,511	5,226	,002	,143
Intercept	89727,539	1	89727,539	207,821	,000	,689
RecallJAofNEE	430,020	1	430,020	,996	,321	,010
StressJAofNEE	5784,356	1	5784,356	13,397	,000	,125
RecallJAofNEE * StressJAofNEE	375,745	1	375,745	,870	,353	,009
Error	40584,957	94	431,755			
Total	138580,000	98				
Corrected Total	47354,490	97				

a. R Squared = ,143 (Adjusted R Squared = ,116)

Repeated measures ANOVA to check whether the stress manipulation worked (from the pre- to the posttest).

Descriptive Statistics

	RecallJ	StressJ	Mean	Std. Deviation	N
	AofNEE	AofNEE			
pre test gespannenheid	niet	niet	21,0000	16,23012	25
		wel	26,5200	18,85276	25
		Total	23,7600	17,63179	50
	wel	niet	25,5455	21,23727	22
		wel	27,5000	16,58976	26
		Total	26,6042	18,67840	48
	Total	niet	23,1277	18,67062	47
		wel	27,0196	17,56302	51
		Total	25,1531	18,11439	98
post test gespannenheid	niet	niet	18,5600	16,55818	25
		wel	37,8800	23,38326	25
		Total	28,2200	22,30063	50
	wel	niet	26,6818	21,31261	22
		wel	38,1538	21,30107	26
		Total	32,8958	21,85566	48
	Total	niet	22,3617	19,16227	47
		wel	38,0196	22,12102	51
		Total	30,5102	22,09504	98

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
time	Linear	1308,330	1	1308,330	26,132	,000	,218	26,132	,999
time * RecallJAofNEE	Linear	25,129	1	25,129	,502	,480	,005	,502	,108
time * StressJAofNEE	Linear	1658,486	1	1658,486	33,126	,000	,261	33,126	1,000
time * RecallJAofNEE * StressJAofNEE	Linear	55,943	1	55,943	1,117	,293	,012	1,117	,182
Error(time)	Linear	4706,198	94	50,066					

a. Computed using alpha = ,05

Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
Intercept	150117,917	1	150117,917	210,353	,000	,691	210,353	1,000
RecallJAofNEE	591,149	1	591,149	,828	,365	,009	,828	,147
StressJAofNEE	4466,708	1	4466,708	6,259	,014	,062	6,259	,697
RecallJAofNEE * StressJAofNEE	397,357	1	397,357	,557	,457	,006	,557	,114
Error	67082,954	94	713,648					

a. Computed using alpha = ,05

Pre- test comparisons (ANOVA's):

Confidence pre- test:

Tests of Between-Subjects Effects

Dependent Variable:gemiddelde zeker pretest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	29,308 ^a	3	9,769	,019	,996	,001
Intercept	334738,962	1	334738,962	647,646	,000	,866
RecallJAofNEE	5,200	1	5,200	,010	,920	,000
StressJAofNEE	15,691	1	15,691	,030	,862	,000
RecallJAofNEE * StressJAofNEE	8,797	1	8,797	,017	,896	,000
Error	51685,504	100	516,855			
Total	387363,062	104				
Corrected Total	51714,812	103				

a. R Squared = ,001 (Adjusted R Squared = -,029)

Vividness pre- test:

Tests of Between-Subjects Effects

Dependent Variable:gemiddelde helder pretest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	148,750 ^a	3	49,583	,092	,965	,003
Intercept	336164,979	1	336164,979	620,936	,000	,861
RecallJAofNEE	22,358	1	22,358	,041	,839	,000
StressJAofNEE	38,577	1	38,577	,071	,790	,001
RecallJAofNEE * StressJAofNEE	89,920	1	89,920	,166	,684	,002
Error	54138,459	100	541,385			
Total	391556,500	104				
Corrected Total	54287,209	103				

a. R Squared = ,003 (Adjusted R Squared = -,027)

Detail pre- test:

Tests of Between-Subjects Effects

Dependent Variable:gemiddelde detail pretest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	95,730 ^a	3	31,910	,063	,979	,002
Intercept	266073,319	1	266073,319	523,042	,000	,839
RecallJAofNEE	3,314	1	3,314	,007	,936	,000
StressJAofNEE	75,905	1	75,905	,149	,700	,001
RecallJAofNEE *	14,107	1	14,107	,028	,868	,000
StressJAofNEE						
Error	50870,402	100	508,704			
Total	317152,500	104				
Corrected Total	50966,132	103				

a. R Squared = ,002 (Adjusted R Squared = -,028)

Accuracy pre- test:

Tests of Between-Subjects Effects

Dependent Variable:gemiddelde acc pretest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	,081 ^a	3	,027	,521	,669	,015
Intercept	61,770	1	61,770	1191,835	,000	,923
RecallJAofNEE	,050	1	,050	,959	,330	,010
StressJAofNEE	,000	1	,000	,005	,946	,000
RecallJAofNEE *	,034	1	,034	,657	,420	,007
StressJAofNEE						
Error	5,183	100	,052			
Total	67,188	104				
Corrected Total	5,264	103				

a. R Squared = ,015 (Adjusted R Squared = -,014)

Recall and stress- manipulations on confidence, vividness, detail and accuracy (repeated measure ANOVA's):

Confidence:

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
time	Linear	144,031	1	144,031	,351	,555	,003	,351	,090
time * RecallJAofNEE	Linear	149,737	1	149,737	,365	,547	,004	,365	,092
time * StressJAofNEE	Linear	28,113	1	28,113	,068	,794	,001	,068	,058
time * RecallJAofNEE * StressJAofNEE	Linear	18,140	1	18,140	,044	,834	,000	,044	,055
Error(time)	Linear	41060,933	100	410,609					

a. Computed using alpha = ,05

Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
Intercept	649982,619	1	649982,619	1245,545	,000	,926	1245,545	1,000
RecallJAofNEE	81,213	1	81,213	,156	,694	,002	,156	,068
StressJAofNEE	,090	1	,090	,000	,990	,000	,000	,050
RecallJAofNEE * StressJAofNEE	,004	1	,004	,000	,998	,000	,000	,050
Error	52184,599	100	521,846					

a. Computed using alpha = ,05

Vividness:

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
time	Linear	431,099	1	431,099	1,056	,307	,010	1,056	,174
time * RecallJAofNEE	Linear	94,126	1	94,126	,231	,632	,002	,231	,076
time * StressJAofNEE	Linear	66,537	1	66,537	,163	,687	,002	,163	,069
time * RecallJAofNEE * StressJAofNEE	Linear	17,046	1	17,046	,042	,839	,000	,042	,055
Error(time)	Linear	40833,913	100	408,339					

a. Computed using alpha = ,05

Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
Intercept	638711,630	1	638711,630	1027,896	,000	,911	1027,896	1,000
RecallJAofNEE	9,090	1	9,090	,015	,904	,000	,015	,052
StressJAofNEE	,393	1	,393	,001	,980	,000	,001	,050
RecallJAofNEE * StressJAofNEE	86,152	1	86,152	,139	,710	,001	,139	,066
Error	62137,791	100	621,378					

a. Computed using alpha = ,05

Detail:

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
time	Linear	3,058	1	3,058	,007	,932	,000	,007	,051
time * RecallJAofNEE	Linear	120,969	1	120,969	,292	,590	,003	,292	,083
time * StressJAofNEE	Linear	,446	1	,446	,001	,974	,000	,001	,050
time * RecallJAofNEE * StressJAofNEE	Linear	8,589	1	8,589	,021	,886	,000	,021	,052
Error(time)	Linear	41430,906	100	414,309					

a. Computed using alpha = ,05

Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
Intercept	529598,468	1	529598,468	967,509	,000	,906	967,509	1,000
RecallJAofNEE	70,966	1	70,966	,130	,720	,001	,130	,065
StressJAofNEE	168,722	1	168,722	,308	,580	,003	,308	,085
RecallJAofNEE * StressJAofNEE	5,669	1	5,669	,010	,919	,000	,010	,051
Error	54738,331	100	547,383					

a. Computed using alpha = ,05

Accuracy:

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
time	Linear	,572	1	,572	9,594	,003	,088	9,594	,866
time * RecallJAofNEE	Linear	,007	1	,007	,124	,725	,001	,124	,064
time * StressJAofNEE	Linear	,005	1	,005	,087	,768	,001	,087	,060
time * RecallJAofNEE * StressJAofNEE	Linear	,003	1	,003	,042	,838	,000	,042	,055
Error(time)	Linear	5,965	100	,060					

a. Computed using alpha = ,05

Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
Intercept	107,296	1	107,296	1838,024	,000	,948	1838,024	1,000
RecallJAofNEE	,053	1	,053	,901	,345	,009	,901	,156
StressJAofNEE	,003	1	,003	,044	,835	,000	,044	,055
RecallJAofNEE * StressJAofNEE	,097	1	,097	1,656	,201	,016	1,656	,247
Error	5,838	100	,058					

a. Computed using alpha = ,05