The Role of Memory Self-Efficacy in Metamemory Beliefs

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PSB3E-BT15: Bachelor Thesis

Group 29

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February 13, 2022

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Abstract

Repression occurs when "a traumatic experience is blocked out of consciousness *automatically* and *unconsciously*" (Sauerland & Otgaar, 2021, p. 1). Earlier studies (e.g. Winkielman et al., 1998) have proposed that retrieval difficulty and metamemory judgments, including repression beliefs, are associated. An online study was conducted to validate these findings. Participants (first-year psychology students at the University of Groningen; n = 111) were randomly assigned to one of two conditions: they were either asked to recall 4 or 12 negative childhood memories. Participants instructed to recall 12 negative childhood memories were expected to (a) report a larger decline in their childhood memory accessibility, (b) show an increase in agreement with repression statements, and (c) report a greater reduction in childhood pleasantness compared to participants who were asked to retrieve 4 memories. Additionally, more agreement with the unspecified compared to the specified repression statements in general was hypothesized. No significant results were found for these hypotheses. This study further assessed memory self-efficacy (MSE) - "a self-judgment about one's ability to perform a given memory task" - in relation to memory performance and other metamemory beliefs (Berry, 1999, p. 70). The hypotheses were: (a) MSE and accessibility are positively associated, (b) MSE and retrieval difficulty are negatively associated, (c) MSE is negatively related to specified (repression components are described in the task) and unspecified (the term 'repression' is named in the task, but not explained) repression beliefs. The results did not conclusively support the hypotheses.

Keywords: memory wars, repression, metamemory, memory self-efficacy

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Repression and The Memory Wars

Repression refers to the defense mechanism "where a traumatic experience is blocked out of consciousness *automatically* and *unconsciously*" (Sauerland & Otgaar, 2021, p. 1). It is not to be confused with suppression, a widely accepted mental process that "involves *conscious* [emphasis added] attempts to remove thoughts and impulses from the mind" (Boag, 2020, p. 4427).

The question of whether or not memories can be repressed is the subject of the so-called "memory wars" in the psychological literature (Crews, 1995). This debate became prevalent after patients with no prior recollection of traumatic experiences started to report recovered repressed memories following suggestive therapeutic interventions (Ceci & Loftus, 1994; Otgaar et al., 2019; Sauerland & Otgaar, 2021). Some researchers have proposed that recovered memories can be authentic (e.g. Brand et al., 2018), whereas others have remained skeptical about repressed memories and have argued that recovered memories are likely to be false memories instead (e.g. Loftus, 1993; Sauerland & Otgaar, 2021). If the memory wars are resolved and a dominant view on repressed memories is established, this might have considerable consequences. For instance, court rulings involving admissible testimonies based on recovered repressed memories will likely differ depending on the outcome of the memory wars debate (Patihis & Pendergrast, 2019; Piper et al., 2008).

Earlier Studies on Repression Beliefs

Researchers have studied what the popular view on repressed and recovered memories is among laypeople as well as mental health professionals (Houben et al., 2021; Patihis et al., 2014). Results showed that laypeople tend to believe in repressed and authentic recovered memories (Patihis et al., 2014), whereas experts in the field of psychology appear to be divided on the subject (Houben et al., 2021; Patihis et al., 2014).

Multiple researchers have studied how the perceived difficulty of memory recall influences individuals' metamemory beliefs, including repression beliefs (Merckelbach et al., 2001; Winkielman et al., 1998; Winkielman & Schwarz, 2001; Cesmeli, 2021; Rieken, 2021). These studies used similar methods including a manipulation of difficulty of recall: participants were asked to complete a task in which they were asked to retrieve and describe several (range: 3 – 4) or a lot (range: 9 – 12) of childhood memories. Each of these studies measured participants' agreement with statements about their own memory following the manipulation.

Winkielman and colleagues (1998) asked participants to judge the completeness of their childhood memory. They found that participants who were asked to recall a lot of childhood memories rated their memory to be less complete than participants who were requested to retrieve several memories.

Winkielman and Schwarz (2001) assessed individuals' beliefs about how pleasant their childhood was. They concluded that recalling a lot of childhood memories whilst holding the belief that negative childhood events are difficult to remember may cause individuals to erroneously evaluate their childhood as unpleasant.

Merckelbach and colleagues (2001) utilized a slightly different manipulation of difficulty compared to Winkielman and colleagues (1998) and Winkielman and Schwarz (2001): participants were specifically asked to remember negative childhood memories. Participants were then asked to rate the extent of their agreement with statements that their childhood memories are difficult to access or repressed. The latter was measured in order to explore how individuals' personal repression beliefs are influenced by the recall of aversive childhood events. Results showed that participants who were asked to retrieve a lot of negative childhood memories assessed their childhood memory accessibility to be lower compared to those participants who recalled only a few. Participants who recollected lots of

negative childhood memories reported less agreement with the statement that many of their childhood memories are repressed compared to participants who recalled only several.

With the intent to replicate the results of the aforementioned three studies, Cesmeli (2021) and Rieken (2021) assessed participants on the following metamemory beliefs after the recall of either several or a lot of childhood memories: accessibility (Merckelbach et al., 2001), completeness (Winkielman et al., 1998), childhood pleasantness (Winkielman & Schwarz, 2001), unspecified repression (Merckelbach et al., 2001), and specified repression (adapted from Houben et al., 2021). The difference between the unspecified and specified repression measures is as follows: the unspecified repression measure includes a direct mention of the label 'repression,' whereas the specified repression statements are "formulated by describing the meaning of a concept [repression] rather than using the label" (Houben et al., 2021, p. 266). The researchers did not find any statistically significant differences between the memory recall conditions and thus failed to replicate the earlier studies (Merckelbach et al., 2001; Winkielman et al., 1998; Winkielman & Schwarz, 2001).

The fact that Cesmeli (2021) and Rieken (2021) failed to find the same pattern of results as the research their study was based on shows a common problem in psychological research: a lack of replication. This replication crisis in psychology is the result of fraudulent behavior by some researchers as well as human error during data collection or analysis (Nelson et al., 2018). That is not to say that the results reported in the earlier studies (Merckelbach et al., 2001; Winkielman et al., 1998; Winkielman & Schwarz, 2001) are false, but rather that the difference in results between those studies and Cesmeli (2021) and Rieken (2021) is noteworthy and that a further replication attempt might clarify how recalling different amounts of memories is related to metamemory beliefs. Pre-registering future studies, including replication attempts, and making data publicly available might reduce the issues prominent in the replication crisis (Nelson et al. 2018).

The Present Study

Replication

This study aimed to be a conceptual replication of Cesmeli (2021) and Rieken (2021), who attempted to validate the findings of earlier studies on metamemory judgments (Merckelbach et al., 2001; Winkielman et al., 1998; Winkielman & Schwarz, 2001). We asked participants to rate their metamemory beliefs (accessibility, completeness, childhood pleasantness, unspecified repression, specified repression) in a similar manner to the original study. The first of two key differences in methodology is that the current study included a baseline that allowed us to measure the impact of the manipulation of difficulty on the metamemory beliefs. Metamemory beliefs were thus assessed before and after the manipulation. The second difference is that the manipulation of difficulty was based on the recall of negative childhood memories only, as was the case in Merckelbach et al. (2001).

We hypothesized that participants who were instructed to recall a lot of negative childhood memories would (a) report a larger decline in their childhood memory accessibility, (b) show an increase in agreement with statements implying the idea that their childhood memories are repressed, and (c) report a greater reduction in their childhood pleasantness compared to participants who were asked to retrieve several negative childhood memories. It was additionally hypothesized that participants would score higher on the unspecified rather than specified repression measures regardless of experimental condition.

Memory Self-Efficacy

We additionally aimed to explore how self-efficacy is related to the perceived difficulty of memory retrieval and the other metamemory beliefs incorporated in this study. Self-efficacy alludes to "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). Berry (1999) developed a definition of self-efficacy specifically for the memory domain: memory self-efficacy (MSE)

refers to "a self-judgment about one's ability to perform a given memory task competently and with confidence" (p. 70).

No research has been done so far on the relation between memory self-efficacy and repression beliefs. Many of the earlier studies on memory self-efficacy have focused on its association with memory performance instead (Hertzog et al., 1990; Iacullo et al., 2016; Lachman et al., 1987; Luszcz & Hinton, 1995; O'Shea et al., 2016; Valentijn et al., 2006). Results showed that memory self-efficacy is positively correlated with objective performance on a variety of memory tasks. This is especially widely documented in literature on episodic memory task performance in older adults (Iacullo et al., 2016; Luszcz & Hinton, 1995; O'Shea et al., 2016). The present study aimed to explore how memory self-efficacy relates to subjective task difficulty and other metamemory judgments, such as unspecified and specified repression beliefs. Finding an association between memory self-efficacy and repression beliefs might help identify how repression beliefs can be influenced. The Memory Self-Efficacy Questionnaire (MSEQ; Berry et al., 1989) was used to assess participants' level of memory self-efficacy in the present study. This self-evaluation measure has been shown to have high reliability and moderate predictive validity with regard to memory performance (Berry et al., 1989).

We expected that, the higher participants score on memory self-efficacy, the (a) easier they will evaluate the memory task to be, (b) the more accessible they will assess their memory to be, and (c) the less they will agree with statements that their childhood memories are repressed.

Method

Statement of Transparency

This study was pre-registered on the Open Science Framework (https://osf.io/64ud9/?view_only=f8eaa839e1a4409fab2709c7d417645f). The used materials

and anonymized data will be made available once the project has been completed. The data analyzed in this thesis was downloaded on January 2, 2022 when n = 113 responses were collected. This was done to ensure that the student researchers were able to finish their bachelor theses in time. Data collection continued until January 15, 2022.

A glitch allowed one participant to enroll in and complete the study twice. Even though an exclusion criteria for multiple participation was not included in the pre-registration, this participant's responses were removed from the dataset in order to reduce the chance of the introduction of (test-retest) bias in the dataset.

Two additional datafiles based on exclusion criteria not mentioned in the pre-registration were created for analysis. The first datafile excludes eight participants who failed to complete the study within a reasonable amount of time (150 minutes, or 2.5 times the upper limit of participation duration described in the research information). The second file excludes 55 participants who failed to report all requested memories (in a serious manner). In order to ensure the effectiveness of our manipulation, the main analyses were conducted using the scores in this file as well.

Post hoc sensitivity analyses performed in G*Power revealed that the tests conducted in this study were less sensitive than desired (Appendix E). This is likely a result of our smaller than anticipated sample size (Faul et al., 2009). It is a possibility that the statistical tests performed in this study are unable to detect an effect that exists in reality because of this lower than desired sensitivity.

Participants

In total, n = 111 first-year psychology students (age: M = 19.93, SD = 2.16, range = 17 – 31) at the University of Groningen participated in the study (Table 1). Recruitment occurred online via the SONA platform where first-year psychology students at the university

received a summary of the research information. Participants were compensated with course credits for their involvement in the study.

Ethics approval for this study (PSY-2122-S-0078) was granted by the Ethical Committee Psychology (ECP) affiliated with the University of Groningen.

Table 1

Characteristics of Participants

	4-Memory Condition *n* = 55	12-Memory Condition *n* = 56
Age (*M* ± *SD*)	20.27 (2.56)	19.59 (1.63)
Male	19 (35%)	8 (14%)
Female	35 (64%)	48 (86%)
Non-Binary	1 (1%)	-

Power Analysis

An a priori power analysis was conducted in G*Power (Faul et al., 2009). The standard significance level $\alpha = .05$ was divided by the amount of statistical tests performed for the main analyses of the study (6) as a means of multiple testing corrections. This resulted in a significance level of $\alpha = .008$. We aimed for a high power (95%) since this study is a replication and we intended to avoid false negative errors. We decided to strive for an effect size of Cohen's $d = 0.5$, which corresponds to a moderate effect size (Cohen**,** 1988). The G*Power analysis revealed a desired sample size of $n = 266$ based on these parameters.

The standard significance level $\alpha = .05$ was used to test the hypotheses regarding memory self-efficacy and metamemory beliefs. This less conservative significance level was chosen in order to lower the chance of false negative errors.

Design

We used a 2x2 mixed factorial design for this study with a between-subject factor of memory task condition (recalling 4 negative childhood memories vs. recalling 12 negative childhood memories) and a within-subject factor of time (completing the metamemory belief

questionnaires before the memory task vs. completing the metamemory belief questionnaires after the memory task).

Materials

Accessibility

Participants' subjective memory accessibility was scored in terms of their agreement with the statement that "many of my childhood memories are difficult to access" on a Visual Analogue Scale (VAS; 0 = strongly disagree, 100 = strongly agree) (Merckelbach et al., 2001).

Completeness

Subjective memory completeness was assessed using a VAS (0 = strongly disagree, 100 = strongly agree) for the item "regarding my childhood memory, there are large parts of my childhood after the age of 5 that I can't remember" (Winkielman et al., 1998).

Unspecified Repression

Unspecified repression beliefs were measured based on participants' agreement with the following statement: "I have repressed many of my childhood memories" (VAS: 0 = strongly disagree, 100 = strongly agree) (Merckelbach et al., 2001).

Specified Repression

Specified repression beliefs were evaluated using VAS (0 = strongly disagree, 100 = strongly agree) for three items ("it is quite possible that certain childhood memories are blocked. That means that they are stored somewhere in my unconscious mind, but I cannot access them, even if I try"; "it is quite possible that certain memories in my unconscious mind cause symptoms"; "it is quite possible that becoming aware (i.e. remembering) of my unconscious memories will lead to a relief from symptoms") (Cesmeli, 2021; Rieken, 2021). This scale was found to have an acceptable level of internal consistency pre-manipulation (Cronbach's $\alpha = .797$) and a good level of internal consistency post-manipulation (Cronbach's

α = .815).

Childhood Pleasantness

Childhood pleasantness was assessed on five items (e.g. "how often did you feel happy in your childhood?") using VAS (0 = not at all pleasant, 100 = extremely pleasant) (Winkielman & Schwarz, 2001). This scale showed good internal consistency pre-manipulation (Cronbach's α = .862) as well as post-manipulation (Cronbach's α = .896).

Difficulty

The difficulty of the memory task was rated using a single item ("you have just been asked to write down several different negative childhood events. How difficult was the task for you?") that was scored with a VAS (0 = extremely easy, 100 = extremely difficult). This item served as the manipulation check for the between-subject factor of the amount of negative childhood memories recalled (Winkielman et al., 1998).

Memory Task

The memory task itself consisted of participants responding to the following questions: "in the space below please write down one negative childhood memory from when you were 5 – 7 years old" and "in the space below please write down one negative childhood memory from when you were 8 – 10 years old." Both questions were followed by the following instruction: "Please specify the place (e.g. 'at school,' or 'at home'), the content and the actors (by noting their initials or relationship status) in the memory" (adapted from Winkielman et al., 1998; Merckelbach et al., 2001).

Memory Self-Efficacy

Memory self-efficacy (MSE) was evaluated using the Memory Self-Efficacy Questionnaire (MSEQ) which consists of items such as "if I looked up 3 phone numbers in the phone book at the same time, I could remember 1 complete phone number plus the first 3 digits in one other phone number" (Berry et al., 1989). Participants rated their memory self-

efficacy on 40 different items, each with its own VAS (0 = strongly disagree, 100 = strongly agree). This is a deviation from the original scoring method that required participants to indicate their confidence level based on increments of ten percent (Berry et al., 1989). As described by Berry et al. (1989), participants' memory self-efficacy strength was calculated using an average of participants' VAS ratings across all dimensions of the MSEQ. This scale showed a good internal consistency of Cronbach's $\alpha = .890$.

Procedure

Participants were recruited from the SONA pools of Dutch and international first-year psychology students at the University of Groningen. The participants were redirected from SONA to the online Qualtrics environment in order to complete the questionnaire individually. Participants were randomly assigned to either the 4-memory or 12-memory condition upon starting the study. Participants first downloaded and read both the research information and informed consent forms. After consenting to participation in the research, participants completed the TAS-20 and CEQ as part of my collaborators' thesis projects. Following this, the pre-manipulation metamemory belief questionnaires and the MSEQ were administered. Between the specified repression and childhood pleasantness questions, participants responded to an attention check (VAS: "please select the very end (at the right) of the scale"). Next, participants in the 4-memory condition recalled and wrote down four negative childhood memories, two from ages 5 – 7 and two from ages 8 – 10. Those in the 12-memory condition recollected and reported six memories from ages 5 – 7 and six from ages 8 – 10 for a total of 12 negative childhood memories recalled. Participants in both conditions then completed the task difficulty manipulation check. Those in the 4-memory condition were requested to recall a further eight memories to ensure that all participants could actually remember 12 negative childhood events. Next, participants were asked to complete the metamemory belief questionnaires again. An attention check (VAS: "please select the very

end (at the right) of the scale") was included between the first and second specified repression questions. Participants were then asked to answer two demographic questions regarding their age (open-ended question) and gender (closed-ended questions with response options 'male,' 'female,' 'non-binary' and 'prefer not to say'). Finally, participants received a debriefing form which outlined the hypotheses of the study, and were given the opportunity to comment on (their participation in) the study. The participants received study credits upon completion of the questionnaire as part of the course *A Practical Introduction to Research Methods*.

Statistical Analyses

Exclusion Criteria

The following exclusion criteria are all in accordance with this study's pre-registration.

Participants who did not consent to participating in the study and/or their responses being analyzed were deleted from the dataset prior to analysis.

Participants who failed either of the attention checks were excluded from the analysis because they may have been responding randomly or carelessly.

The data was analyzed once with outliers (scores more than 1.5 times outside of the IQR) included in the data and once with outliers excluded from the dataset.

Assumptions

Assumptions underlying the conducted tests were checked using IBM SPSS Statistics 26. Figures showing the distribution and normality of relevant variables can be found in Appendix A and D.

Accessibility, Completeness, and Childhood Pleasantness

The baseline score for each of the accessibility, completeness, and childhood pleasantness items was subtracted from the relevant post-manipulation score to form a change score. The mean change score for each of these metamemory beliefs was subjected to a one-tailed independent samples Welch *t*-test grouped by condition.

For accessibility and completeness, this was done to test the hypothesis that participants who were asked to retrieve a lot of memories would report a larger decline in accessibility and completeness than those who were asked to recall a few memories.

In the case of childhood pleasantness, the relevant change score was used to test the hypothesis that participants in the 12-memory condition would report a greater reduction in childhood pleasantness compared to participants in the 4-memory condition.

Difficulty

Difficulty scores were subjected to a one-tailed independent samples Welch *t*-test to test whether or not the manipulation was effective.

Repression

Baseline scores on unspecified repression were subtracted from the post-manipulation scores to compute an unspecified repression change score. Baseline scores on the average of specified repression items were subtracted from the post-manipulation scores to compute a specified repression change score. Independent samples Welch *t*-tests were conducted for both mean change scores in order to test the hypothesis that participants in the 12-memory condition would show a greater increasement in their agreement with the specified and unspecified repression statements.

Average scores of the unspecified repression and specified repression items in the study were computed. These scores were subjected to a paired samples *t*-test to test the hypothesis that participants would score higher on unspecified compared to specified repression items.

Memory Self Efficacy (MSE)

Self-efficacy strength (SEST) was computed based on the mean MSEQ scores. Pearson's correlation coefficients were calculated between memory self-efficacy and baseline

accessibility, baseline unspecified repression, baseline specified repression, and difficulty. Two outliers were detected on the SEST variable (Appendix C).

Results

Main Analyses

The main analyses were conducted using (a) a file which includes outliers (n = 111), (b) a file which excludes outliers (n = 86) (Appendix C), (c) a file that excludes participants who failed to complete the study within 2.5 hours (n = 103), and (d) a file which excludes participants that did not report all requested memories (n = 56). These analyses on different files all returned the same results per hypothesis in terms of statistical significance.

In accordance with the pre-registration, the results of analyses on the first two files can be found in the main text (Table 2, 3), whereas the results of the additional two files are summarized in Appendix B.

Manipulation of Difficulty

Participants in the 12-memory condition rated the memory task be statistically significantly more difficult compared to those in the 4-memory condition (Table 2, 3). The manipulation of difficulty was thus successful.

Accessibility and Completeness

Independent Welch *t*-tests of accessibility and completeness were conducted. Contrary to our hypothesis that participants in the 12-memory condition would report a larger decline in their childhood memory accessibility and completeness than participants in the 4-memory condition, no statistically significant differences between conditions were found (Table 2, 3).

Childhood Pleasantness

We hypothesized that participants in the 12-memory condition would report a greater reduction in childhood pleasantness compared to participants in the 4-memory condition. An

independent samples Welch *t*-test did not return a statistically significant result between conditions on this variable (Table 2, 3).

Table 2

Results of Independent Samples Welch t-Tests Comparing Change Scores and Difficulty per Condition (Outliers Included)

	4-Memory Condition *n* = 55		12-Memory Condition *n* = 56		*t*	*df*	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*				
Accessibility	3.05	20.45	9.84	22.23	-1.67	108.54	.097	-.318
Completeness	3.93	22.09	11.27	18.61	-1.89	105.29	.061	-.359
Spec. Rep.	1.12	11.46	2.38	19.32	-0.42	89.73	.678	-.079
Unspec. Rep.	1.81	21.27	10.73	18.08	-2.38	106.6	.019	-.452
Pleasantness	-.44	5.12	-.97	8.84	.39	88.44	.699	.074
Difficulty	50.47	24.16	70.48	20.92	-4.66	106.25	< .001*	-.885

Note. Spec. Rep = specified repression; Unspec. Rep. = unspecified repression.

* p < .008.

Table 3

Results of Independent Samples Welch t-Tests Comparing Change Scores and Difficulty per Condition (Outliers Excluded)

	4-Memory Condition *n* = 45		12-Memory Condition *n* = 41		*t*	*df*	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*				
Accessibility	3.00	18.81	10.34	16.22	-1.94	83.79	.055	-.418
Completeness	3.80	20.01	9.24	16.21	-1.39	82.90	.168	-.299
Spec. Rep.	2.19	11.15	.72	10.26	.64	83.99	.526	.137
Unspec. Rep.	2.58	12.00	9.15	14.13	-2.31	78.88	.023	-.501
Pleasantness	-.68	4.00	-.28	4.85	.98	77.80	.322	-.216
Difficulty	50.20	24.89	68.71	21.40	-3.71	83.73	< .001*	-.797

Note. Spec. Rep = specified repression; Unspec. Rep. = unspecified repression.

* p < .008.

Repression

It was hypothesized that participants in the 12-memory condition would show a greater increase in their agreement with the specified and unspecified repression statements.

The conducted independent samples Welch *t*-tests returned no statistically significant results (Table 2, 3).

We also hypothesized that participants would score higher on unspecified compared to specified repression. A paired samples *t*-test comparing unspecified and specified repression revealed a statistically significant result in the opposite direction of the hypothesis: participants had higher mean scores on the specified (M = 46.97, SD = 22.78) compared to the unspecified repression (M = 36.03, SD = 24.58) statements (Table 4).

Table 4

Results of Paired Sample t-Tests Comparing Unspecified and Specified Repression

	t	*df*	*p*	Cohen's *d*
Outliers Included	4.80	110	< .001*	.456
Outliers Excluded	4.18	85	< .001*	.451

* p < .008.

Memory Self-Efficacy (MSE)

Memory self-efficacy is operationalized by means of a self-efficacy strength variable (M = 62.6, SD = 14.9).

We hypothesized that we would discover a positive relationship between memory self-efficacy and accessibility. Correlation analyses revealed a small statistically non-significant negative association between the two variables in this sample (Table 5, 6).

We additionally suggested that memory self-efficacy might be negatively correlated to unspecified repression, specified repression, and difficulty. Results of correlation analyses showed a small statistically non-significant negative association between memory self-efficacy and both specified repression as well as difficulty (Table 5, 6). A small statistically non-significant positive association between memory self-efficacy and unspecified repression was found in the sample (Table 5, 6).

Table 5

Pearson's Correlation Coefficients of SEST and Accessibility, Repression, and Difficulty (Outliers Included)

	SEST
Accessibility	-.139
Unspecified Repression	.053
Specified Repression	-.151
Difficulty	-.128

Note. SEST = self-efficacy strength.

** $p < .05$.

Table 6

Pearson's Correlation Coefficients of SEST and Accessibility, Repression, and Difficulty (Outliers Excluded)

	SEST
Accessibility	-.108
Unspecified Repression	.110
Specified Repression	-.109
Difficulty	-.084

Note. SEST = self-efficacy strength.

** $p < .05$.

Discussion

The goal of this study was to see if we could replicate earlier findings on the relationship between memory task difficulty and metamemory beliefs (Merckelbach et al., 2001; Winkielman et al., 1998; Winkielman & Schwarz, 2001). In addition to this, the present study aimed to explore whether task difficulty and memory self-efficacy and/or other metamemory judgments, such as repression beliefs, and memory self-efficacy are associated.

Summary of Results

Four main hypotheses were tested in an attempt to meet the aforementioned aims of the study: we initially hypothesized that participants who were asked to retrieve a lot of negative memories would (a) report a larger decline in their childhood memory accessibility, (b) report a greater reduction in their childhood pleasantness, and (c) show a larger increase in

agreement with statements which suggested that their memories are repressed compared to participants who were asked to retrieve only several negative childhood memories. We additionally believed that participants would score higher on unspecified than specified repression.

The first three of these hypotheses were tested using a manipulation of difficulty. The underlying assumption here is that recalling a lot of (negative) memories is subjectively evaluated to be more difficult than retrieving just a few (Winkielman et al., 1998). The manipulation was successful and had a moderately large (outliers included) to large effect size (outliers excluded) (Cohen, 1988). No conclusive evidence to reject the null hypothesis of no difference between means was found for these three hypotheses when difficulty was used as a discriminator. Small statistically non-significant negative effect sizes were found for all relevant variables – except for specified repression where the effect was also inconclusive and small but positive – when outliers were excluded from the analysis. These results deviate from earlier findings by Merckelbach and colleagues (2001), Winkielman et al. (1998), and Winkielman and Schwarz (2001). Cesmeli (2021) and Rieken (2021) were unable to replicate these studies' findings as well.

Contrary to our fourth hypothesis, participants scored statistically significantly higher on specified repression items compared to unspecified repression questions. The size of this effect is small to moderate.

The current study expanded on previous research on the relationship between difficulty of retrieval and metamemory beliefs by examining how memory self-efficacy relates to accessibility, repression beliefs, and perceived difficulty of the memory task. It was hypothesized that the higher participants score on memory self-efficacy, the (a) easier they will assess the memory task to be, (b) the more accessible they will evaluate their memory to be, and (c) the less they will agree with statements that their memories are repressed. These

hypotheses were based on earlier findings linking memory self-efficacy to improved memory performance on a variety of tasks. Results showed small statistically non-significant correlations between memory self-efficacy and other metamemory beliefs as well as difficulty. The associations between memory self-efficacy and accessibility, specified repression, and difficulty in the sample were negative as theorized, but they were not significant. The relationship between memory self-efficacy and unspecified repression was positive, yet also statistically non-significant.

Implications

It might be the case that the present study and Cesmeli (2021) and Rieken (2021) could not replicate the results of earlier studies on metamemory judgments (e.g. Winkielman et al., 1998) because the theories proposed in those studies do not hold. The statistically significant results found by Merckelbach and colleagues (2001) may have been the result of methodological limitations, such as a small sample size. The small sample size (n = 52) likely resulted in low statistical power and potentially a high proportion of false positives. It is also possible that the theories proposed in these earlier studies do not sufficiently describe the actual mechanisms of metamemory judgment formation that might explain the findings.

The statistically significantly higher mean found for the specified repression compared to the unspecified repression beliefs could be interpreted as a consequence of the unspecified repression statement containing the word 'repression' itself. This label may have a negative connotation which could have negatively influenced participants' agreement scores on this variable. The specified repression statements, on the other hand, are more open to interpretation by the participants, which means that the participants may not have been affected by their pre-existing beliefs about the label 'repression' before rating their agreement with these statements.

The operationalization of memory self-efficacy in this study through statements that

describe uncommon memory tasks may have resulted in incorrect memory self-efficacy strength assessments by individuals (Beaudoin & Desrichard, 2011). This is a potential explanation as to why the results of the correlation analyses were statistically non-significant.

Previous studies on memory self-efficacy (e.g. Beaudoin & Desrichard, 2011; Valentijn et al., 2006) have reported significant associations between memory self-efficacy and objective memory task performance. It is possible that such relationships simply do not exist when memory task performance is rated subjectively by participants themselves, as was done in the present study.

It is possible that age moderates the relationship between memory self-efficacy and memory performance. Previous studies (e.g. Valentijn et al., 2006) have predominantly used older adults (M_{age} = 66.1) in their samples, whereas this study used student participants (M_{age} = 19.9) only. It has previously been suggested that memory self-efficacy might be a better predictor of (future) task performance when a change – usually a decline – in memory function over time is expected (Valentijn et al., 2006). Such a change might be more relevant for older adults compared to young adults, as cognitive abilities decline with age. Earlier findings on age as a moderator with regard to the relationship between memory self-efficacy and memory task performance include significant correlations between memory self-efficacy and memory task performance in older adults, but not younger adults (e.g. West et al., 2006; Luszcz & Hinton, 1995). It might be beneficial for further studies on this topic to perform moderator analyses on the age variable in order to validate these findings.

Methodological Considerations

One limitation of the present study is that it was conducted in an online environment (partially) during the Christmas break. Two possible issues with such a design is that we could not control for a distracting environment as well as outside help with regard to memory retrieval. To clarify the latter point, in a laboratory setting the researchers can almost

guarantee that participants complete the study under their own power. In an online setting, however, it is possible that participants receive help from others in answering questions. In the present study, participants could have asked family members or friends for help during the memory retrieval task. This could then have influenced the perceived difficulty of the task rating as well as the post-manipulation metamemory judgment scores. It might thus be beneficial for researchers to conduct a similar future study in person rather than online.

A second limitation with this study concerns the sample. It is firstly important to note that our sample consists of only first-year psychology students at the University of Groningen. In addition to this, a majority of participants in the sample are women. In this sense, our sample is biased and may not accurately portray the relationships between the examined variables. The study's results may therefore have little generalizability. A far more prominent issue with the analyzed sample is its size. Since data was downloaded for analysis two weeks before data collection was scheduled to stop, the desired amount of participants $n = 266$ was not reached. Instead, the results of the current study are based on four (sub)samples, the largest of which is sample of $n = 111$ participants. The smaller sample size resulted in a lower than desired sensitivity with an increase in the likelihood of false negative errors as a result. The fact that our analyses were performed on four different (sub)samples was a deviation from our pre-registration, in which we mentioned that we would conduct analyses on two files: one with outliers included and one with outliers excluded. The interpretations of results were the same across all four datafiles.

Another consideration is that the current study utilized a baseline. This allowed for an assessment of the influence of the manipulation of difficulty on metamemory judgments. Including a baseline is a deviation from earlier studies on this topic (Merckelbach et al., 2001; Winkielman et al., 1998; Winkielman & Schwarz, 2001; Cesmeli, 2021; Rieken, 2021). The fact that the independent samples Welch *t*-tests conducted in this study are based on change

scores of means rather than means may explain why we were unable to previous findings by Merckelbach et al. (2001), Winkielman et al. (1998), and Winkielman and Schwarz (2001). Future research on this subject should include a baseline of metamemory beliefs in order to validate the results of the present study.

Conclusion

This study aimed to replicate earlier findings regarding metamemory judgments and their association with difficulty of memory recall. A second goal of the current study was to assess the relationship between memory self-efficacy and other metamemory judgments. The results show no conclusive support for the idea that the perceived difficulty of memory retrieval influences metamemory judgments, nor for the view that the concept of memory self-efficacy is related metamemory beliefs.

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Appendix A

Histograms showing the distribution of relevant variables can be found in the figures below.

Figure 1

The Distribution of Accessibility (Change Variable)

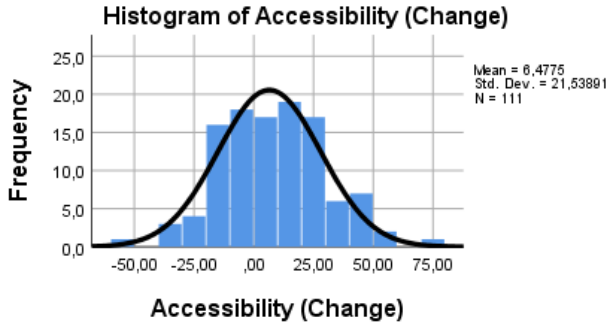


Figure 2

The Distribution of Completeness (Change Variable)

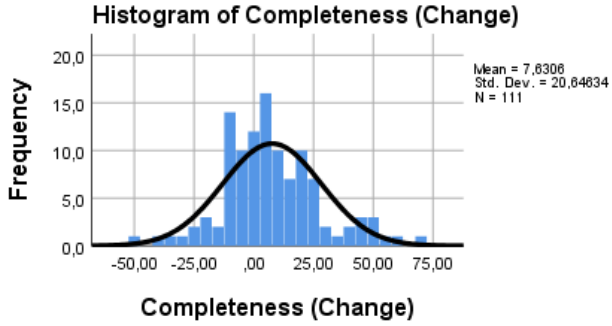


Figure 3

The Distribution of Specified Repression (Change Variable)

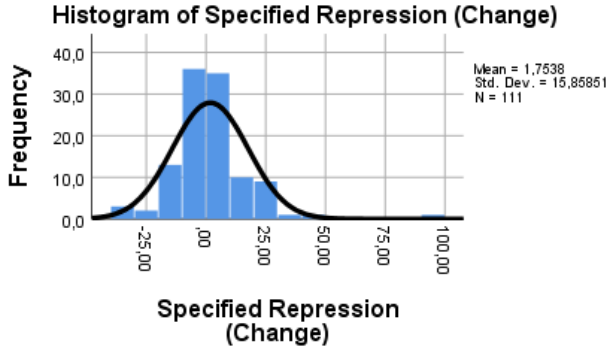


Figure 4

The Distribution of Unspecified Repression (Change Variable)

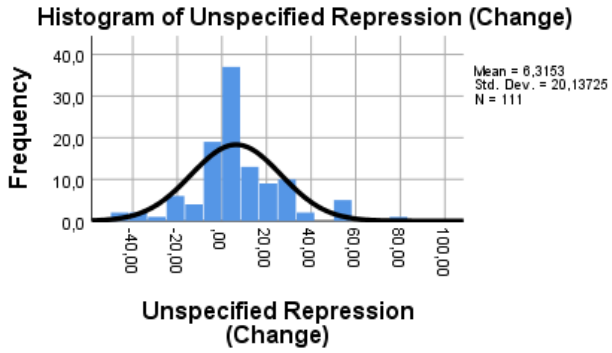


Figure 5

The Distribution of Childhood Pleasantness (Change Variable)

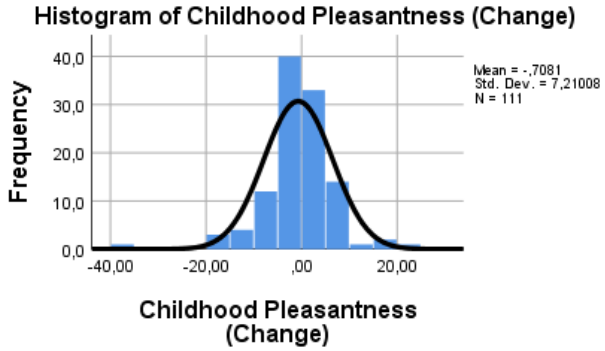
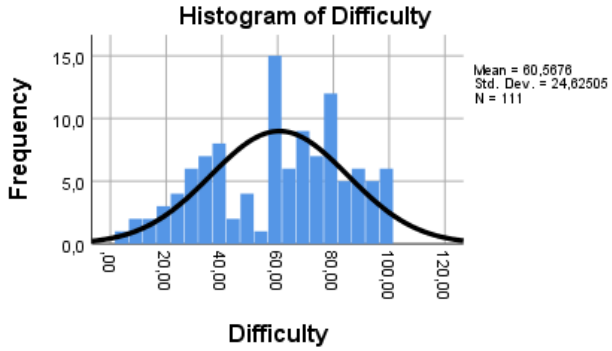


Figure 6

The Distribution of Difficulty



Appendix B

Tables showing the results of independent samples Welch *t*-tests in the datafiles which exclude participants on the basis of participation duration and incomplete memory content, respectively, are shown below.

Table 7

Results of Independent Samples Welch t-Tests Comparing Change Scores and Difficulty per Condition (Duration Exclusion)

	4-Memory Condition $n = 51$		12-Memory Condition $n = 52$		*t*	*df*	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*				
Accessibility	2.57	20.81	10.06	22.49	-1.76	100.66	.082	-.346
Completeness	2.94	21.62	11.08	19.16	-2.02	99.07	.046	-.398
Spec. Rep.	1.30	11.48	3.24	19.18	-.62	83.68	.535	-.123
Unspec. Rep.	1.16	21.89	9.54	17.47	-2.15	95.45	.034	-.423
Pleasantness	-.33	5.25	-1.30	9.03	.671	82.26	.504	.132
Difficulty	51.04	23.87	69.75	21.50	-4.17	99.47	< .001*	-.824

Note. Spec. Rep = specified repression; Unspec. Rep. = unspecified repression.

* p < .008.

Table 8

Results of Independent Samples Welch t-Tests Comparing Change Scores and Difficulty per Condition (Memory Content Exclusion)

	4-Memory Condition $n = 28$		12-Memory Condition $n = 28$		*t*	*df*	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*				
Accessibility	19.05	3.60	9.50	23.82	-2.07	51.52	.044	-.553
Completeness	.32	23.62	12.82	20.39	-2.21	52.87	.039	-.567
Spec. Rep.	1.06	11.99	4.08	25.21	-.57	38.62	.570	-.153
Unspec. Rep.	.32	27.79	11.82	17.87	-1.84	46.07	.072	-.492
Pleasantness	-.76	3.96	-2.34	9.92	.79	35.40	.437	.210
Difficulty	46.61	24.50	70.89	17.94	-4.23	49.49	< .001*	-1.131

Note. Spec. Rep = specified repression; Unspec. Rep. = unspecified repression.

* p < .008.

Table 9

Results of Paired Sample t-Tests Comparing Unspecified and Specified Repression

	t	*df*	*p*	Cohen's *d*
Duration	4.04	102	< .001*	.398
Memory	3.17	55	.003*	.423

Note. Duration = sample without participants who failed to complete the study within 2.5 hours; Memory = sample without participants who failed to report 12 memories in total.

* $p < .008$.

Appendix C

Boxplots showing the distribution and outliers for relevant variables are shown below.

Figure 7

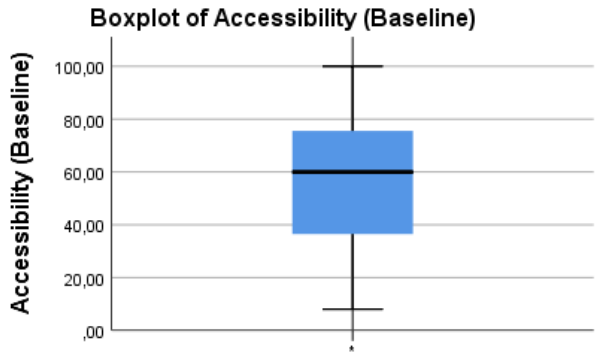


Figure 8

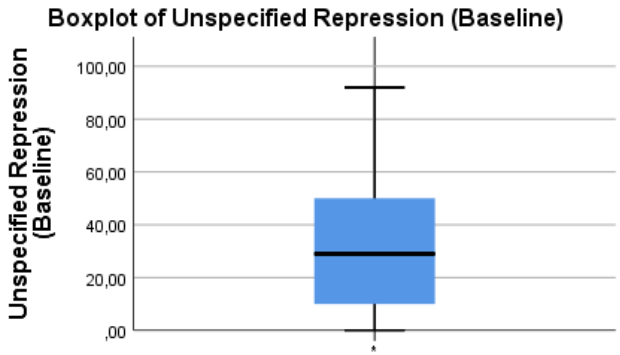


Figure 9

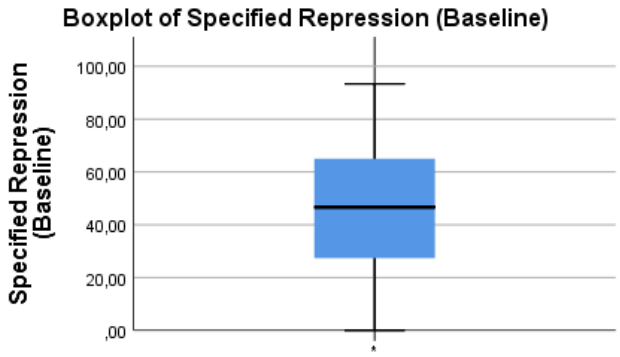


Figure 10

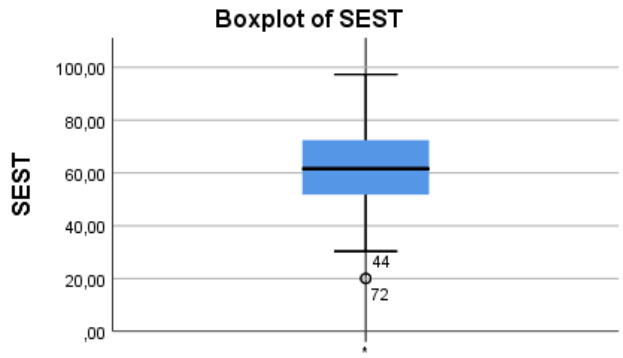


Figure 11

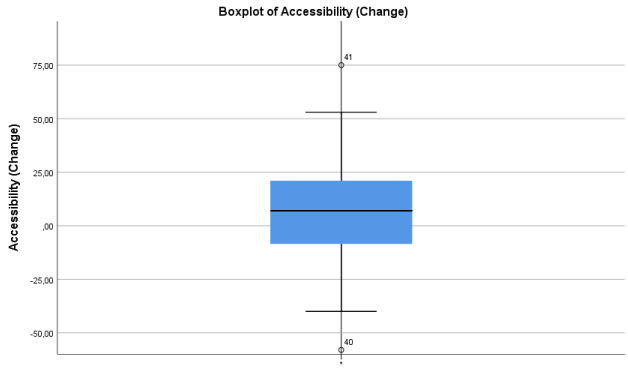


Figure 12

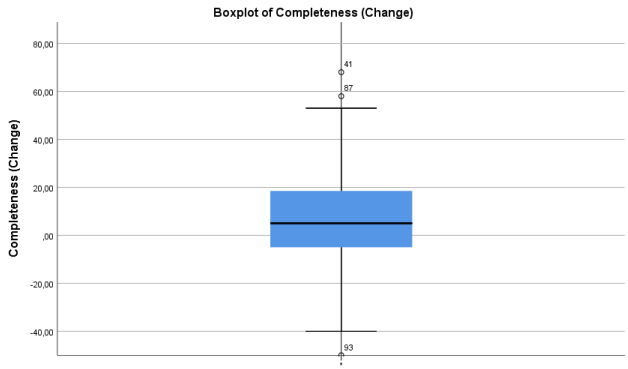


Figure 13

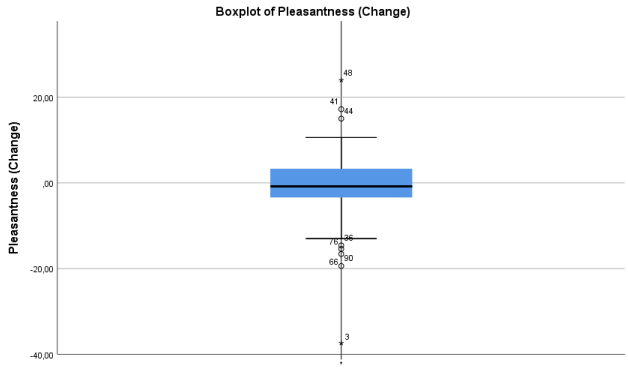


Figure 14

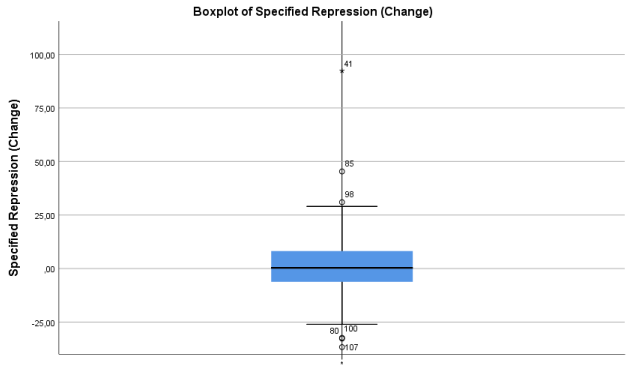
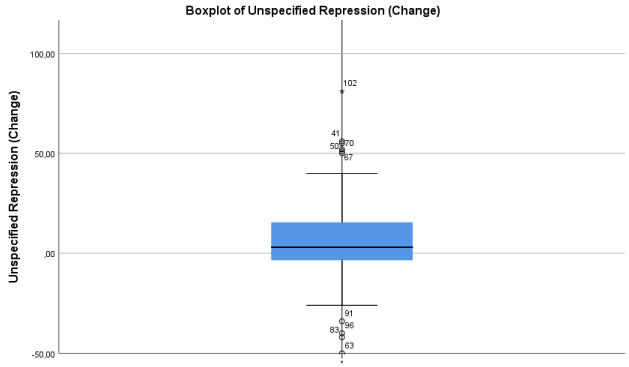


Figure 15



Appendix D

Scatterplots showing the relationships between SEST and relevant variables are shown in the figures below.

Figure 16

Scatterplot of SEST against Accessibility

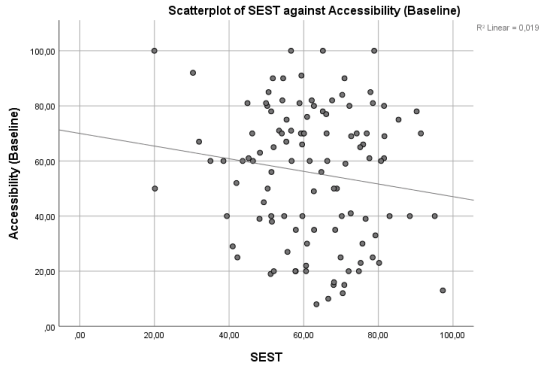


Figure 17

Scatterplot of SEST against Unspecified Repression

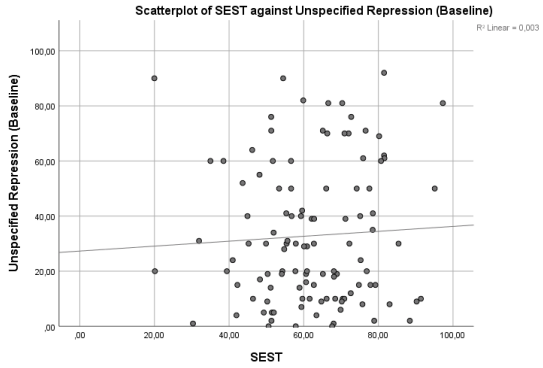


Figure 18

Scatterplot of SEST against Specified Repression

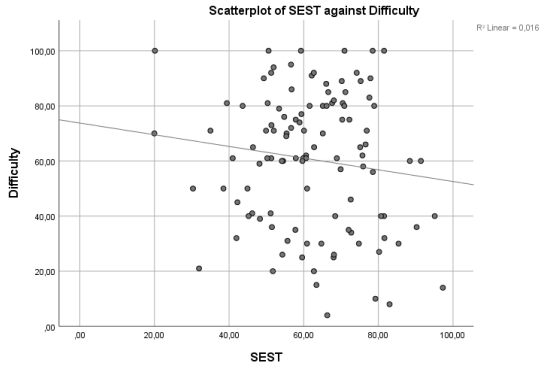
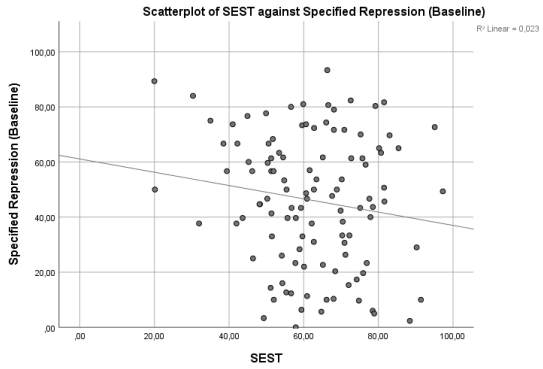


Figure 19

Scatterplot of SEST against Difficulty



Appendix E

Outputs of the post hoc sensitivity analyses conducted in G*Power are listed below.

[1]
t tests - Means: Difference between two dependent means (matched pairs)
Analysis: Sensitivity: Compute required effect size

Input:	Tail(s)	=	One
	α err prob	=	0.008
	Power (1-β err prob)	=	0.95
	Total sample size	=	111
Output:			
	Noncentrality parameter δ	=	4.1082758
	Critical t	=	2.4467141
	Df	=	110
	Effect size dz	=	0.3899403

[2]
t tests - Means: Difference between two independent means (two groups)
Analysis: Sensitivity: Compute required effect size

Input:	Tail(s)	=	One
	α err prob	=	0.008
	Power (1-β err prob)	=	0.95
	Sample size group 1	=	55
	Sample size group 2	=	56
Output:			
	Noncentrality parameter δ	=	4.1087856
	Critical t	=	2.4470661
	Df	=	109
	Effect size d	=	0.7800090