Depression as a moderator of the association between emotion regulation and working memory.

Master Thesis Clinical Psychology

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Abstract

Objective: The purpose of the present study was to examine a proposed model wherein depressive symptomatology has a moderating role on the relationship between emotion regulation and working memory (WM). Also the effect of instructed emotion suppression was thought to be negatively correlated with WM capacity (WMC). *Methods:* The sample consisted of 82 healthy female participants, mainly students. There were two conditions, one emotion suppression instruction, the other with no instruction. Emotion was elicited through a video fragment, the depressive symptomatology was measured using the BDI-SF, and Automated Symmetry Span Task was used to measure WMC. *Results:* There was no direct relationship between emotion regulation and WM. However, there was a marginal interaction effect with a small to medium effect size for the moderation hypothesis. *Conclusion:* The results indicate that the presence of depressive symptoms reinforce the effect of instructed emotion regulation on WMC. The presented theory suggests that this has to do with difficulties in both regulating emotions and regulating the content of the WM. This interaction loads the WM and depletes its capacity. The fact the effect is marginal suggests interpretations must be made prudently.

Keywords. depression, working memory, emotion regulation, expressive suppression, cognitive resources.

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Introduction

Depression, also known as Major Depressive Disorder (MDD) or Clinical Depression, is typically characterised as an affective disorder. However, an increasing number of studies is expecting cognitive variability to positively correlate with this disorder (Gotlib & Joormann, 2010; Leen, Hermens, Porter, & Redoblado-Hodge, 2012; Rock, Roiser, Riedel, & Blackwell, 2014). Its relevancy being that depression was recently named the leading cause of disability worldwide by the World Health Organisation. The working memory (WM), responsible for short-term information availibility, is negatively affected by depression (Gotlib & Joormann, 2010; Rose & Ebmeier, 2006). WM is paramount for complex tasks such as learning, reasoning, and comprehension (Baddeley, 1992).

Not only can WM impairment be caused by depression, but also by emotion dysregulation (Ehring, Tuschen-Caffier, Schnülle, Fischer, & Gross, 2010; Joormann, 2010; Joormann & Stanton, 2016) seen repeatedly in cases of depression. Richards & Gross (2000) developed a theory suggesting that maladaptive emotion regulation is related to WM impariment. They noted a decline in the WM during emotion regulation tasks. Their findings are supported by Kemps et al. (2006).

Remarkably, multiple psychologists suggest that symptoms innate to depression, such as a depressed mood, rumination and anhedonia, may be conceptualized as the consequence of emotion regulation deficits. Namely, literally not being able to (down-)regulate emotions (Campbell-Sills & Barlow, 2006; Gross & Munoz, 1995; Kovacs, Joormann, & Gotlib, 2008). Joormann (2010) described these deficits in emotion regulation as an effect of dysfunctioning cognitive inhibition; the inability to inhibit the processing of negative material.

Presented are three independent correlating pairs of concepts. Depression and WM, emotion regulation and WM, and emotion regulation and depression, respectively. Combining these three pairs to create a unprecedented model is the goal of the present study. In this paper, we investigate whether WM impairment is the result of emotion dysregulation moderated by depression by means of an experiment where participants are divided into two groups: one group with an emotion dysregulation instruction, another group with no instruction.

Expressive suppression, the inhibition of expression of currently experienced emotion, is one such maladaptive forms of emotion regulation often seen in individuals with depression (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Gross, 2013). This makes the maladaptive

expressive suppression a response-focused technique as opposed to reappraisal, which is an adaptive antecedent-focused technique. Response-focused or antecedent-focused describe a point in time, respectively after or before the emotional response to a stimulus according to Gross' Process Model of Emotion Regulation (2001) (Goldin, McRae, Ramel, & Gross, 2008). Gross (2002) argues this is relevant, because the response-focused suppression technique requires responsive self-corrective and self-monitoring action which depletes mental resources. Although expressive suppression is seen as a risk factor for depression, as yet there are no certainty claims to be made about the chain of causality at this point (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Khalaila & Cohen, 2016).

Gaining insight into how the WM operates will help understand its relation to depression and emotion regulation. The Multicomponent Model of Working Memory (Baddeley & Hitch, 1974) describes its operation and states that the WM consists of four systems: the attentional control system - the central executive -, two subsidiary storage systems, being the visuo-spatial sketchpad (VSSP) for information in a visual or spatial form and the phonological loop (PL) for written or spoken information, and finally the episodic buffer, which forms an interface between the three working memory subsystems and long-term memory (Baddeley, 2007). The VSSP and the PL are systems with a relatively easy definable finite capacity, also known as the working memory capacity (WMC). The VSSP and the PL are therefore most often the subject of working memory tasks in experimental setups (Baddeley, 1992).

Previous studies have tested Baddeley's model through a dual-task paradigm; individual performing two tasks simultaneously compared to individual performing a single task (Bruyer & Scailquin, 1998). The reasoning behind the dual-task paradigm is that when two concurrent tasks rely on the same cognitive resource, they interfere with one another. In the context of testing Baddeley's model, the dual-task paradigm helped to define the domain of the different WM systems. However, in the context of the current study, the dual-task paradigm can give an insight into whether the aforementioned theory, discussing that the WM decline is related to maladaptive ER strategies in cases of depression, works through the same mechanism. Namely, that resorting to emotional suppression relies on cognitive resources in the WM.

As an example of the dual task paradigm working mechanism, imagine the following experiment. Sitting down, try to make a repeating circular motion with the toes on your left foot, whilst making a repeating horizontal left-to-right motion with the toes on your right foot.

This is a difficult, for most near impossible, exercise due to both actions being reliant on your VSSP. Contrarily, making a circular motion with the toes on either foot and simultaneously reciting the alphabet backwards (which requires due concentration) proves less of a challenge than it would be doing these tasks individually. Reciting the alphabet relies on the PL system, whereas your foots motion relies on the VSSP. In the first scenario, there clearly is some degree of interference, while there is none in the second. Translated to the context of the current study this would mean that, if the theory is correct, actively suppressing emotional expressions makes it more challenging to perform a working memory task.

What disables individuals from infinitely calling upon these mental resources? The ego-depletion model of Baumester et al. (1998) rationalize why individuals are prevented from infinitely calling upon these mental resources. This model describes the role of interference in the WM. Baumeister et al. found that these finite mental resources are used by the four main parts of behavioral and emotional self-regulation: thought control, emotion control, impulse control and task performance. The subsidiary systems of the WM, the PL and the VSSP, fall under *thought control*. Baumester et al. describe emotion control as a load for mental resources. This means that calling upon the WM for either the PL or the VSSP, in other words taxing the WM, while at the same time suppressing ones emotion, can be described as a dual-task paradigm. Deficits in the WM in cases of depression would be explained by this, for individuals at risk for depression show an inability to control the contents of their WM (Joormann, 2010). These individuals unvoluntarily loading their WM with mood-congruent, or depressed, cognitions could be a consequence. This could possibly be attributed to the inability of these individuals to inhibit the processing of negative material (Joormann, 2010). The objective of the current study is to put these theories to the test.

The present study uses an between-group design with two groups. The design had an emotion suppression instruction in one group and no instruction in the other group. By asking the participants to suppress the negative emotions brought up by a negative emotion induction through a disturbing video fragment, the VSSP is specifically targeted. In accordance with the ego-depletion model, a WM task that also speaks to the VSSP shall be selected. As span tasks, such as the digit span (Hoosain, 1979), speak tot he PL, we opt to measure the WM capacity through the automated symmetry span task (Conway, et al., 2005). This task speaks to the VSSP, and hence will show a decrease in score if the WM is affected by expressive suppression.

Our conjecture is that individuals instructed to actively suppress their emotion expression will score lower on the WM task than those not in the no instruction group. Moreover, we expect that this effect is more pronounced for individuals having reported depressive symptoms. In other words, we hypothesize that depressive symptoms will moderate this relationship.

Methods

Participants

The participating sample consisted of 90 women between the ages of 18 and 67 (M = 21.57, SD = 6.01) years. Eight women were excluded because of having an incomplete data set. The participating group consisted of solely women, principally between the ages of 18 and 40, on account of the data also belonging to a parallel study concerning eating disorders. For this reason, inclusion criteria for participants corresponds to the age and gender of the adult eating disorder population (Smink, van Hoeken, & Hoek, 2012). That being said, the current group of participants is not representative of the depressive population (Lewinsohn, Rohde, & Seeley, 1998). Participants were primarily recruited through posters at Utrecht University and through psychology student focused social media groups. The current study was able to offer mandatory participation credits to psychology students, substituting financial compensation. Participants that were not enrolled for psychology at Utrecht University were not compensated. This resulted in 91.5% of the participants being a student. All participants were asked to agree to an informed consent before the study commenced. The research proposal was passed by the ethics committee beforehand.

Measurements

The present study saw it fit to use a between-group design for the present study. The experiment was single blind, meaning the participants did not know of the condition they were allocated to. The condition was either the suppression instruction group, or the no instruction group. The suppression instruction group was regarded as the treatment group, and the no instruction group was the control group. The manipulation, which will be described further on in this section, was applied to all participants.

Measurements working memory

To measure the WM, the Automated Symmetry Task (SymmSpan) (Conway, et al., 2005) was used, this task can be classified as a so-called complex span task.. The name derives from the fact that the task includes a symmetry judgement element and a memory span element. Complex span tasks are commonly used in behavioural studies in the cognitive and individual-differences literature, whereas n-span and n-backwards span tasks have been used more frequently in cognitive neuroscience studies investigating the neural underpinnings of working memory (Redick & Lindsey, 2013). The task asks the participant to remember and recite a sequence of specific tiles on a 4 x 4 grid in a given order. Symmetry tasks interceded the moments the tiles were presented. In these tasks the participant was asked whether a certain figure, also presented in black and white tiles on a 8 x 8 grid, is symmetrical on its vertical axis. To eliminate quick learning advantages, a practice round for both the memory task and the symmetry task was given as an introduction. Afterwards the tasks were combined. To give an example of a *set*; firstly a red square was illuminated in the 4 x 4 grid, then a symmetry judgement would appear, followed by another red square meant for recall, another symmetry judgement and finally the last red square. Before each answer moment there is always a symmetry judgement, and the participant would subsequently have the opportunity to recall the sequence of red-square locations of the preceding displays in the order they appeared by clicking on the cells of an empty 4 x 4 matrix. The list of red-squares ranged from two to five and each set size had three trials.

The symmetry span task has a test-retest reliability for partial-credit scoring is .77, which is acceptable (Redick, et al., 2012). In a previous study the internal consistency – also based on the partial-credit scoring - had a Cronbach's alpha of .76 was which is also acceptable (Kane, et al., 2004). From the output the SymmSpan provides, the value 'SSPAN', sum of all correctly recalled squares of correctly recalled sets, was used to reflect the WMC.

Measurements depressive symptoms

The short form of the Beck Depression Inventory (BDI-SF) was used to measure depressive symptoms (Beck & Beck, 1972). The BDI is the most widely used instrument for measuring depressive symptoms and depressive disorders. This short form correlates highly

with both the longer form of the BDI as with clinicians' ratings of depression (Beck, Rial, & Rickels, 1974; Reynolds & Gould, 1981). This self-report measure of the severity of depression consists of 13 statements which can be agreed or disagreed upon through four possible responses, ranging in intensity. A statement would for example be "I still enjoy the things I used to". Normally a cut-off would be decided upon, since the current study merely wishes to measure the presence of symptoms this will not be necessary. Literature on the internal consistency of the BDI-II (the instrument which the BDI-SF derives from) reports a Cronbach's Alpha ranging from .73-.92 for nonpsychiatric populations (Beck & Steer, 1984). Test-retest reliability has been adequate but more variable (Dozois, Dobson, & Ahnberg, 1998). The present study has found a good internal consistency with a Cronbach's alpha of .86.

Measurements emotion regulation

To be able to make a statement regarding randomisation across the two instructed groups, the present study administered the Emotion Regulation Questionnaire (ERQ). Through the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) the spontaneous emotion regulation strategies of the participants were mapped. Statements posed by the questionnaire can be confirmed or denied. The two sub-scales of the questionnaire are expressive suppression and cognitive reappraisal. The questionnaire consists of 10 statements which can be agreed or disagreed upon through a 7-point Likert scale, and would for example say "I control my emotions by not expressing them".

The validity an12d reliability were tested by Gross & John (2003). With mean reliability of .73 and a test-retest reliability of .69 the questionnaire has proven to be acceptably valid and reliable. The current study finds a Cronbach's alpha of .80 for internal consistency for the expressive suppression subscale.

Procedures

After signing the informed consent, the experiment was able to start. In a setting with little to no distractions the participants were presented with the questionnaires and the WM

task, all programmed in Inquisit 5 (Millisecond). Two additional questionnaires were filled in manually by the participant, the DTS and the EDDS. The order the participants received the tests in was identical. After receiving general instructions, the ERQ, followed by the emotion pre-check were presented. Depending on the condition the participant was assigned to, the participant was asked to either suppress the emotion that would be brought up by the film fragment, or asked nothing. A movie fragment inducing negative emotion was shown after the instruction. The fragment was from the movie "American History X", a movie from 1998 produced by Morrissey. The 3-minute fragment shows a neo-Nazi executing two black men. After the fragment an emotion post-check was performed together with a computerized visual analogue scale to assess motivation for the task, and the participants went on to perform the automated symmetry task. Demographic information was assessed, the BDI-SF was taken and the height and weight were determined. Finally, the participants were asked to fill out a printed version of the DTS and the EDDS. After the assessment, the participants were debriefed and asked for their experience. Possibilities to be kept posted for research results were also offered. Note that this study is part of larger study, not all measured data will be used in the present study.

Data-analysis

Data analyses were carried out with IBM SPSS Statistics 24. Using the boxplot and function, all scales were checked for outliers. Four outliers for age were found, this did not seem to be a problem as they did not correspond to other outlying data. For the BDI three outliers were found. This did not form a problem because some variance was desirable. No outliers were found on the SymmSpan nor were there any outliers for the ERQ.

Administering the ERQ enabled the present study to see whether the two conditions were similar as regards to the spontaneous expressive suppression the participants were inclined to use. A T-test for independent groups shall analyse whether randomization was successful for this factor. Sufficient randomization with respect to age and education shall also be analysed using a t-test for independent groups.

The first hypothesis "the individuals with the instruction to actively suppress their emotion expression will score lower on the WM task than the group without the instruction" was tested using a t-test for independent samples.

The second hypothesis " depressive symptoms will moderate this (hypothesis 1) relationship: individuals with the instruction to actively suppress their emotion expression will score lower on the WM task when they have reported having more depressive symptoms" was tested using a univariate ANOVA, altering the syntax to include a moderation term. For this analysis, the scores on the BDI were standardized.

Results

Sample characteristics

Participants were allocated to two different conditions. There was no difference in age, $t(80) = -0.38$, $p = .70$., the tendency to suppress emotion expression (ERQ score), $t(80) = 0.46$, $p = .65$, depressive symptom scores (BDI), $t(80) = 1.29$, $p = .20$ or the reported amount of negative emotions before watching the video fragment, $t(80) = -0.44$, $p = .66$. Mean scores and corresponding standard deviations are listed in Table 1.

The assumption of normality, an assumption that must be checked for the statistical procedures in the current analysis, was not met for the scores on the BDI. However, with the current sample size this should not cause a problem for the sample is large enough (Ghasemi & Zahediasl, 2012).

Negative mood induction

Using a video fragment, the present study intended to induce the experience of negative emotions. For both conditions this intention was met with success. The experience of negative emotion was significantly elevated in both conditions after being presented the video fragment. Mean scores and corresponding standard deviations are listed in Table 1.

Suppression instruction and WM

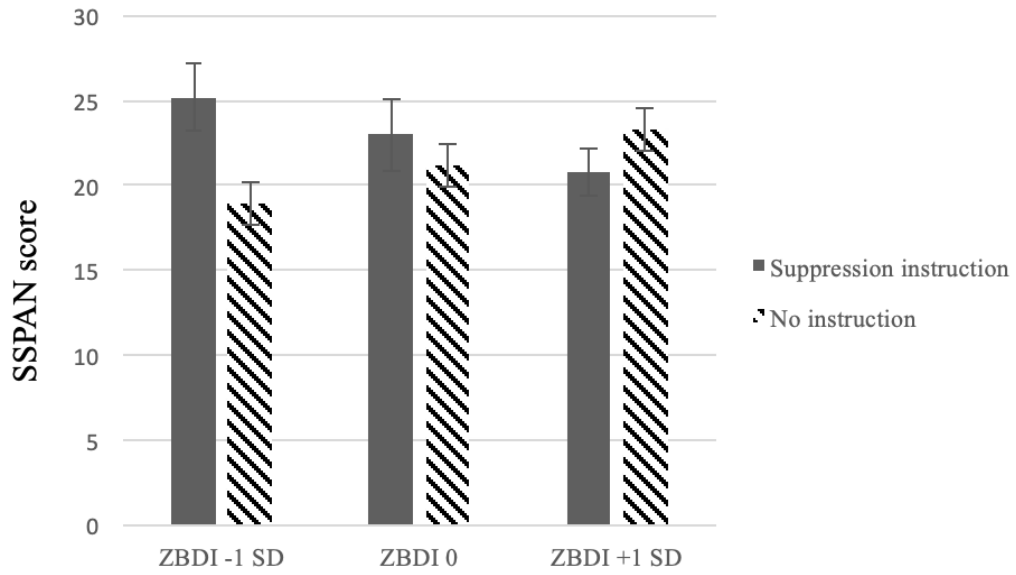
The first hypothesis is interested in the main effect of the instruction versus the no instruction condition on WM. A t-test for independent groups was performed. The WM, measured with the SymmSpan, score for the instruction group did not differ from the no instruction group significantly, $F(80) = 1.64$, $p = .36$. This means that the instruction given to the different conditions did not have the predicted effect on the WM score. Mean scores and corresponding standard deviations are listed in Table 1.

Moderation effect of depressive symptoms on the effect of the suppression instruction on WM

The second hypothesis unveils the moderation effect of depressive symptoms on the main effect of emotion suppression on WMC. Using an univariate ANOVA the moderation effect was analysed. The direct effect of depressive symptoms on WMC was not significant, $F(1) = 0.00$, $p = .99$ with $\eta^2 = 0.011$ Nor was the direct effect of condition on WMC significant, $F(1) = 0.85$, $p = .36$, with $\eta^2 = 0.011$. Maintaining a significance level of $p = .05$, the moderation effect did not prove statistically significant , $R^2 = .065$, adjusted $R^2 = .030$ with $F(1,80) = 3.75$, $p = .056$. The significance level of the moderation was however high enough to indicate a marginal interaction effect. The corresponding η^2 is .046, indicating a small to medium effect size. To help interpret this interaction effect, it is presented graphically in Figure 1. Here the SSPAN scores are displayed as a factor

Figure 1

Mean scores and standard errors between conditions at three different levels of depression symptomatology: low depression level (ZBDI -1 SD), average depression level (ZBDI 0), high depression level (ZBDI +1 SD).



Note. SSPAN=sum of all correctly recalled squares of correctly recalled sets on Symmetry Span Task, ZBDI=standardized sum scores on Beck's Depression Inventory.

Table 1

Mean scores and corresponding standard deviations between conditions (the instruction group or the no instruction group) of demographic characteristics and the effect of the negative emotion induction as well as the scores on emotion regulation (ERQ- expressive suppression), the working memory task (SymmSpan-SSPAN) and depression symptomatology (BDI-SF).

	Suppression instruction condition (Mean (SD))	No instruction condition (Mean (SD))
Age	21.32 (3.94)	21.83 (7.58)
Education (% student)	95%	93%
Negative emotions experienced before the video fragment (0-100)	30.80 (23.03)	29.90 (19.81)
Negative emotions experienced after the video fragment (0-100)	63.78 (16.79)	72.17 (19.35)
ERQ-expressive suppression	13.05 (4.75)	12.58 (4.47)
SymmSpan-SSPAN	22.68 (9.83)	20.83 (8.42)
BDI-SF score	4.80 (.83)	3.54 (.53)

Note. EDDS=Eating Disorder Diagnostic Scale, SSPAN= sum of all correctly recalled squares of correctly recalled sets, SymmSpan=Symmetry Span Task, BDI-SF=Beck's Depression Inventory Short Form.

Discussion

The current study examined whether the suppression of emotion expression has an influence on the working memory capacity (WMC). The second goal was to examine whether depressive symptoms affected this relationship. The rationale for the second goal being that research has shown that both individuals reporting a relatively high inclination to suppress the expression of their emotions (Ehring et al., 2010, Joormann, 2010; Joormann & Stanton, 2016), and individuals diagnosed with depression (Gotlib & Joormann, 2010; Rose & Ebmeier, 2006) show a lower WMC. The present findings do not support that the suppression instruction condition exhibits a lower WMC. For the second hypothesis, stating that depressive symptoms will moderate the effect of emotion suppression on WMC, a marginal effect was found, albeit not statistically significant.

Firstly, the present findings are not in line with results from previous studies that investigate the role of expressive suppression on memory (Richards & Gross, 1999; Richards & Gross, 2000). Richards and Gross (1999) presented stimuli during a period where suppression was activated experimentally, and measured incidental memory. Incidental memory denotes the memory of objects that were not intentionally remembered . In an interlocking study, Richards and Gross (2000) tested verbal memory during suppression compared to controls. A detrimental effect on verbal memory during suppression was found.

On the other hand, a study from Ehring and colleagues (2010), in which they tested whether depression vulnerability was related to difficulties with expressive suppression, did report findings similar to the current in a study on recovered-depressed versus never-depressed participants. There are two large differences between the study of Ehring and colleagues and the current study. Firstly, Ehring's study did not look into working memory, or another cognitive function for that matter. Instead, in this study only the negative mood was measured after watching the video fragment, as a measure for the ability to down-regulate the experience of negative emotion through reappraisal. Secondly, instead of one set with a video fragment followed by a moment of measurement, there were two sets. In the first set, Ehring and colleagues looked at the spontaneous means of emotion regulation, identified through the ERQ. In the second set, much like in the current design, emotion regulation was manipulated. The instruction was either to suppress the expression of emotion or to reappraise the emotions. In the first set where the emotion regulation was spontaneous, differences were found in negative mood between recovered-depressed and never-depressed individuals. Ehring and colleagues also found that the participants who were recovered from their depression reported to have used emotion suppression more frequently than control participants in the first set. This suggests that the recovered-depressed group, inclined to spontaneously suppress expression, had notable difficulties down-regulating their emotions. This could be explained by the inability to use the adaptive form of emotion regulation, reappraisal. The second set yielded different results and no significant differences were found between groups. The common denominator for both the present study and the second set of Ehring’s experiment is the regulation instruction. With the findings deriving from the first set of Ehring’s experiment in mind, it can be assumed that the involuntary instruction to regulate emotions yields distorted results and can possibly be regarded as a weakness in the present study’s design.

Subsequently, the findings do plead in favor of the second hypothesis. Even though the results do not prove significant, the interaction is effect is large enough to indicate that the hypothesis was not far off and that there is good reason for this moderating role of depressive symptoms to be studied more. It is important to note that the effect is moderating in the present findings because depressive symptoms alone were not related to WMC. In the present moderation, the presence of depressive symptomatology are said to reinforce the effect of instructed expressive suppression. The theory supporting this hypothesis holds up with the present results. For, suppression alone in the experimental scenario, hypothetically speaking the suppression in cases who do not report any depressive symptomatology, is a smaller load for the WM than the suppression instruction in those whom have reported to experience mild to moderate depressive symptomatology. For, experiences that resemble depressive symptoms, such as a depressed mood and rumination, may be conceptualized as the consequence of expressive suppression (Campbell-Sills & Barlow, 2006; Kovacs, Joormann, & Gotlib, 2008), since the use of expressive suppression makes it more difficult to down-regulate these negative emotions. The augmentation of these negative emotions, which are not down-regulated, result in a depressed mood and other symptoms of depression. This leads to a larger taxation of the mental resources in individuals that both are instructed to suppress their emotional expression and report depressive symptoms, in other words the interaction effect. This is reflected by their score on the WM task. This lower score on the the WM task is in turn explained by the Dual Task Paradigm.

Strengths, limitations and implications for future research

A strength in the present study is the sample. For the present study being part of a larger study focussing on eating disorders, the sample was uniform with regard to age, sex and education level. Since cognitive capability, and thereby WMC, are influenced by many factors (Baddeley, 1992), the uniform sample helped towards keeping many of such factors constant throughout the sample. This was important because this made it possible for the present study to focus on the effect of the manipulation.

The success of the present study also relied on the emotion induction to succeed. As is displayed in the results, this induction was very successful. The present method of eliciting emotions with this film fragment has proven to be strong through previous research (Berna,

Ott, & Nandrino, 2014; Schaefer, Nils, Sanchez, & Phillipot, 2010). Again, the uniformity of the sample with regard to gender reinforced the effect of the film-elicited emotion induction. Females respond more strongly to emotion inducing film fragments than males (Fernández, et al., 2012).

The present study did not actively recruit participants with a diagnose of depression, because the present study did not wish to compare a never depressed to a depressed group. The aim of the present study was to investigate the cognitive consequences in case of increasing depression symptomatology. As a result, the current sample did not represent a large amount of individuals with a significantly elevated level of depressive symptoms. The BDI-SF warrants the use of a cut-off score of 13/14 to indicate a moderate risk of depression if specificity is desired (Furlanetto, Mendlowicz, & Bueno, 2005). The current sample contained only three individuals that scored above the 13/14 (clinical) cut-off score. This becomes problematic when applying the theory put forward by Joormann & Gotlib (2010). This theory advocates that the key mechanism responsible for the decline in WM, also puts the individual at risk for depression, most probably resulting in a score above the cut-off. In the present study this means that a mere three participants in the sample have trouble regulating negative emotions resulting in experiences resembling depressive symptoms in such a way they scored above this cut-off. Besides revising this theory, a follow-up study would be wise to compare a healthy group to a group that has proven to be at risk for depression. For this risk indicates the incapability to adaptively regulate (negative) emotions, according to the theory of Joormann and Gotlib. The latter shall enable the study to make a statement regarding these findings. Currently, the present findings are not generalizable to a depressed population with the current sample.

With regard to the present study design, Gross (2002) had a similar study design to the current, with a disgust inducing film fragment and three experimental conditions; a suppression instruction, a reappraisal instruction and no instruction. Even though memory was not a measured in this study, findings do indicate that the the design helped to achieve post-manipulation between-condition differences in behavioral, experiential and physiological responses. It must be noted that the suppression and reappraisal conditions could be distinguished from one another on all three levels. Analysis of results between the suppression condition and the no instruction condition yielded less significant results. This suggests that future studies should use three conditions as opposed to the two in the present study.

Comparing the results from a suppression instruction to a reappraisal instruction is more reliable due to the instruction itself possibly causing a testing bias.

Also, the experimental setup of the study did not contain a manipulation check. The participants in the suppression instruction condition were not asked whether they actually managed to use expressive suppression as means of regulation their emotion. This manipulation check would have enabled the present study to correct for participants in the suppression instruction condition who reported to not have used expressive suppression. Still, previous studies have used similar negative emotion inductions with emotion regulation instructions, not controlling for this factor, achieving desired effects (Davidson, Putnam, & Larson, 2000; Ehring, et al., 2010; Richards & Gross, 2000; Evers, Marijn Stok, & de Ridder, 2010). Looking at these other studies, we can assume the manipulation had no reason not to work.

In the present study the second hypothesis assumes a model where depression is a moderator for the effect of emotion dysregulation on working memory. However, certain symptoms characteristic for depression possibly have a direct effect the working memory. For example, symptoms such as insomnia/hypersomnia and fatigue (American Psychiatric Association, 2013) may well cause cognitive decline (Chee & Choo, 2004). For this reason, future study could include a mediation analysis and compare this to a moderating analysis. Since the causality of the relationship between depression, emotion dysregulation and working memory has not yet been unravelled.

Furthermore, Joormann (2010) noted that symptoms innate to depression may be conceptualized as a consequence of emotion dysregulation. By combining the two possible direct effects, it is quite possible that merely the presence of individual symptoms of depression, caused by this dysregulation of emotion, rather than the depression considered as a disorder, are correlated to the WM impairments. The resulting implication for future studies is that it is recommended to perform analyses for individual symptoms of depression. Single symptoms of depression correlating strongly with WM impairments would indicate a stronger direct effect of depressive symptoms on WM.

In conclusion, the present study has partly succeeded in its aim to discover the presence of a complex relationship between depressive symptoms or vulnerability, expressive suppression and working memory capacity. The marginal interaction effect that was found indicates there is something to be said about the presented theory. The present study has hypothesized that in

presence of depressive symptoms, expressive suppression has a negative effect on working memory capacity. This proposed a moderation effect. The theory behind this hypothesis being that the presence of depressive symptoms indicate an incapability of adaptively regulating the emotions, and thereby the content of the WM. The instruction to actively suppress emotions in individuals that have reported depressed symptoms, a marker for said incapability, would reinforce this resource taxing effect and also load cognitive resources in and of itself. Through a cognitive task the present study measured whether this was indeed the case, and whether the presence of depressive symptomatology and the instruction to suppress emotional expression interacted with one another. The marginal interaction effect shows that the moderation hypothesis had a plausible theory but still needs further examination to make statements about its precise nature.

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