INTERRELATIONSHIPS BETWEEN AUTOBIOGRAPHICAL MEMORY SPECIFICITY, EXECUTIVE FUNCTIONS AND RUMINATION IN DEPRESSION

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DECLARATION OF ORIGINALITY

I, Burcu Kaya Kızılöz, certify that

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ABSTRACT

Interrelationships Between Autobiographical Memory Specificity,

Executive Functions and Rumination in Depression

Depression is associated with reduced specificity of autobiographical memories (Williams & Broadbent, 1986), a phenomenon defined as overgeneral memory. It has been suggested that rumination, impairments in executive functions and functional avoidance underlie OGM (Williams et al., 2007). The present study has three main goals: 1) to examine whether different executive functions are affected by depression differently 2) to clarify the nature of the relationship between rumination and executive functioning deficits and 3) to examine the effects of cue type on memory specificity in depression. To reach these aims, participants were divided into two groups according to their Beck Depression Inventory (BDI) scores as high (n = 45) and low (n = 51) BDI participants. They then completed the Ruminative Responses Scale and EF tasks for shifting, updating and inhibition and reported important and word-cued ABMs. Results showed that word-cued memories resulted in more OGMs than important memories for all participants, regardless of BDI scores. Only shifting predicted specificity of autobiographical memories for word-cued memories but not for important memories. Consistent with earlier claims, certain EF deficits were related to OGM for word-cued memories, but no evidence of a link between rumination and OGMs was found.

ÖZET

Depresyonda Otobiyografik Anı Belirliliği, Yönetici İşlevler ve Ruminasyon Arasındaki Karşılıklı İlişkiler

Depresyon otobiyografik anıların daha genel bir şekilde hatırlanmasıyla ilişkilidir ve bu durum aşırı genelleme olgusu (AGO) olarak tanımlanmaktadır (Williams & Broadbent, 1986). Ruminasyonun, yönetici işlevlerdeki bozuklukların ve işlevsel kaçınmanın AGO'ya yol açtığı öne sürülmüştür (Williams et al., 2007). Bu çalışmanın 3 amacı bulunmaktadır: 1) farklı yönetici işlevlerin depresyonda farklı şekillerde etkilenip etkilenmediğini incelemek 2) ruminasyon ve yönetici işlevler arasındaki ilişkininin doğasını açığa kavuşturmak ve 3) kullanılan ipucu türünün depresyonda anı belirliliği üzerindeki etkilerini araştırmak. Bu hedeflere ulaşmak amacıyla katılımcılar Beck Depresyon Envanteri (BDE) sonuçlarına göre yüksek BDE (n = 45) ve düşük BDE (n = 51) olmak üzere iki gruba ayrılmıştır. Katılıcımlar, Ruminatif Tepkiler Ölçeğini ve değiştirme, güncelleme ve baskılama yönetici işlevleri için farklı görevleri tamamlamışlar, en önemli anılarını ve ipucu kelimelerin hatırlattığı anılarını anlatmışlardır. Sonuçlar, BDE sonuçlarından bağımsız olarak, ipucu kelimelerin hatırlattığı anıların daha fazla AGO'ya yol açtığını göstermiştir. Yalnızca değiştirme işlevi ipucu kelimeler için anı belirliliğini yordamıştır. Çalışmanın savlarına uyumlu olarak bazı yönetici işlev bozuklukları AGO ile ilişkili bulunmuş ancak ruminasyon ve AGO arasında bir ilişki olduğuna dair bir bulgu görülmemiştir.

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CHAPTER 1

INTRODUCTION

The present research intends to investigate the relation between depression and autobiographical memory (ABM) with a focus on Overgeneral Memories (OGMs). With this purpose, two studies were conducted to examine this relationship in detail using the CaR-FA-X model (Williams et al., 2007) as the main frame. CaR-FA-X, structured upon the Self Memory System (SMS) proposed by Conway and Plydell-Pearce (2000), claims that in depression, impairments in one or more of the three mechanisms [Capture and rumination (CaR), functional avoidance (Fa), and impaired executive functions (X)] cause impairments in ABM leading to overgeneral memories (OGM). Based on this conceptualization, present study aims to explore the contributions of rumination and EF impairments to OGM with a focus on the relation between the CaR-FA-X (Williams et al., 2007) model and SMS (Conway & Plydell-Pearce, 2000).

1.1 Depression and autobiographical memory

Autobiographical memory is defined as memory for personal experiences of the rememberer, accompanied by a sense of recollection and reliving (Greenberg & Rubin, 2003; Williams, Conway, & Cohen, 2008). ABM is seen as a part of declarative memory, consisting of both semantic and episodic components (Urbanowitsch, Gorenc, Herold, & Schröder, 2013). The semantic domain consists of general facts about the individuals, whereas the episodic domain involves the mental reconstructions of the event with the feeling of reliving. ABM is affected by psychiatric conditions like Mild Cognitive Impairment (e.g., Urbanowitsch et al.,

2013), Alzheimer ’s disease (e.g., Addis & Tippett, 2004), Post-Traumatic Stress Disorder (e.g., Rubin, Berntsen, & Bohn, 2008), and Major Depressive Disorder - MDD (e.g., Williams et al., 2007).

DSM-V defined MDD as a mood disorder characterized by impaired mood and absence of interest in daily activities for a period longer than 2 weeks (American Psychiatric Association, 2013). MDD symptoms include depressed mood and irritability, loss of interest in most activities, diminished appetite or weight change, insomnia or hypersomnia, decreased energy and increased fatigue, change in daily activity levels, increased feelings of guilt and decreased self-esteem, impaired ability to concentrate and thoughts of self-harm.

The effects of MDD on cognitive functions are well established. MDD is related to impairments in verbal and visual explicit memory (e.g., Austin, Mitchell, & Goodwin, 2001), concentrating (e.g., Gotlib & Joorman, 2010), learning (e.g., McClintock, Husain, Greer, & Cullum, 2010), both free and cued recall of information and mental flexibility (e.g., Airaksinen, Larsson, Lundberg, & Forsell, 2004), attention (e.g., Marazziti, Consoli, Picchetti, Carlini, & Faravelli, 2010), impairments in EF, (e.g., Austin, et al., 2001; Marraziti, et al., 2010), and ABM (e.g., Williams & Broadbent, 1986; Williams, et al., 2007). Williams and Broadbent (1986) showed that suicide survivors failed to report specific memories in response to positive and negative cue words. This difficulty in recalling personal events in a specific way is referred as overgeneral memory phenomenon. There is a vast literature (e.g. Goddard, Dritschel, & Burton, 1997; Kuyken & Brewin, 1995; Raes, Hermans, Williams, Demyttenaere, et al., 2006) with other important aspects of psychological functioning. Among the cognitive defects related to depression, present study aims to investigate the effects of depression on ABM with a focus on

OGM. In the next section, the relationship between ABM and MDD and the presence of OGM in MDD will be discussed in depth.

1.2 Overgeneral memory

Williams and Broadbent (1986) conducted the first study demonstrating the reduced specificity of ABMs in depression. Originally, the study was aimed to investigate the effects of mood on ABM. With this purpose, inpatients receiving treatment for MDD who attempted suicide were tested with Autobiographical Memory Test (AMT). Participants were given a minute to retrieve a specific ABM to each of the 10 cue words referring to five positive (happy, surprised, interested, successful and safe) and five negative emotions (clumsy, angry, sorry, hurt, and lonely. The memories were then coded as specific (a unique event that occurred within 24 hours, e.g. the day I started college), general (all memories except specific ones, e.g. my college years) or as non-memories. Total number of specific and categorical memories recalled served as measures of OGM. Williams and Broadbent (1986) found that ABMs of suicide survivors were different than controls in terms of specificity level, content and speed of processing. Memories reported by the suicide survivors were less specific and reported slower.

A number of studies supported the findings of Williams and Broadbent (1986). Williams and Dritschel (1988) replicated their findings showing that inpatient suicide survivors still under treatment reported more OGMs than the controls replicating earlier findings. Moreover, they showed that older patients who completed the treatment and were discharged from the hospital were not different from the controls in terms of OGMs indicating that depression did not cause a permanent change on ABM. Williams and Scott (1988) extended these finding by

examining individuals diagnosed with depression without suicide history. They showed that compared to healthy participants, participants with depression were slower to report ABMs and were less likely to retrieve specific memories. These results suggested that OGM was not limited to individuals with suicide tendencies but rather it is related more directly depression.

This relation between depression and OGMs were supported by a number of studies (e.g, Kuyken & Dagleish, 1995; Moffitt, Singer, Nelligan, Carlson & Vyse, 1994, Moore, Watts & Williams, 1988). Trying to uncover the roots of this relationship, Kuyken and Brewin (1995) investigated ABM in women diagnosed with MDD with and without a history of physical or sexual abuse during childhood. They found that participants who reported sexual abuse during childhood reported more OGMs to both positive and negative cues suggesting a relationship between OGMs and childhood trauma. This study was the first to demonstrate this relationship

In light of the accumulating evidence, Williams (1996) first proposed the affect-regulation hypothesis to explain OGM. Later, he proposed the CaR-FA-X model (Williams et al., 2007), which is more extensive than the affect regulation hypothesis in terms of covering different factors affecting the relationship between MDD and OGM. In the following two sections, affect regulation hypothesis and CaR-FA-X model will be discussed in detail.

1.3 Affect regulation hypothesis

According to the affect regulation hypothesis (Williams, 1996), when children experience traumatic events, this experience disrupts the normal development of ABM. In order to reduce the negative effects of the trauma and avoid the intense and

primary emotions awakened by the specific memories related to it, children who were exposed to negative experiences learn to retrieve painful memories associated with these experiences in a more general way to be able to retrieve painful details in a less focused and less intense way. This tendency to recall memories in a general way continues during adulthood.

Raes, Hermans, de Decker, Eelen, and Williams (2003) tested the affect regulation hypothesis in a non-patient sample. Undergraduates completed AMT and were classified as high or low specific as an indication of their retrieval styles based on the number of specific memories they recalled. If they recalled a specific memory for each of the 10 cue words, they were classified as high-specific participants. Participants who recalled 6 or less specific memories were classified as low-specific. Raes et al. (2003) aimed to test the suggestion that that OGMs are caused with an intent to decrease negative affect caused by negative experiences. Therefore, they used the Tangram Puzzle Task to manipulate frustration manipulation (difficult version as frustration and easy version as no frustration conditions) to increase the negative affect. Results showed that for the frustration condition, subjective stress level of the low-specific group was lower than that of the high-specific group, and the low specific group rated their memories of the event they recalled as less unpleasant. According to Raes et al. (2003) these results were due the low specific groups tendencies to retrieve events in a less specific way. They suggested that retrieving ABMs at a less specific level reduced the effect of the negative event for people in the low specificity group, which was viewed as a support to the affect regulation hypothesis.

However, Philippot, Schaefer and Herbette (2003) challenged this finding. In their study, three events from the diaries of daily emotional experiences of

undergraduates were used as cues in a retrieval task. During the retrieval task, participants were read either a specific or a general event. They were then asked to imagine these events and rate the emotional intensity associated with them. The results showed that participants who received a specific event to access ABM also showed less emotional intensity during mental imagery, which was contradictory to what Raes et al. (2003) reported. In a second study, Philippot et al. (2003) showed emotional video clips to the participants and asked them to recall specific or general memories related to the themes shown in the video clips. Supporting the results of their first study, participants who recalled specific memories rated their emotions as less intense. Hence, challenging the affect regulation hypothesis, Philippot et al. (2003) concluded that retrieving specific memories decreased emotional intensity associated with these memories.

Raes, Hermans, Williams, and Eelen (2006) conducted two studies to address these contradictory findings. In study 1, they replicated the findings of Raes et al. (2003) by comparing high and low specific participants for positive and negative events. In line with the affect regulation hypothesis, they showed that groups were different only for the negative events. Low-specific group showed lower distress levels than the high-specific group for the negative events. Moreover, participants with repressive coping style retrieved more general memories. However, even when repressive coping was controlled, OGM was related to a decrease in negative emotions. In study 2, low specific undergraduates were randomly assigned to one of the four conditions based on memory induction (specific vs. general) and type of experience (neutral vs. negative). For memory induction, participants in the specific condition were asked to recall specific memories cued by 9 positive and 9 negative words, whereas participants in the general condition were asked to name an event

cued by the same words. After the memory induction, participants were assigned either to neutral or negative conditions (easy or difficult Tangram Puzzle task, respectively). The results supported Philippot et al.'s (2003) findings: Participants in the general memory condition reported more intense negative emotions if they were also in the negative condition. Raes et al. (2006) reasoned that the underlying mechanism behind this finding might be the relation between rumination and OGM. They claimed that the induction of general memory retrieval might have induced a ruminative mind set in participants before they experienced the emotional event. Therefore, the researchers concluded that these results did not actually contradict with the affect regulation hypothesis.

Although there are studies showing remembering ABMs in a less specific way aids emotion regulation (e.g. Raes et al., 2003) supporting the affect regulation hypothesis, there are also studies showing that remembering ABMs in a specific way aid emotion regulation (e.g. Philippot et al., 2003) contradicting the affect regulation hypothesis. These contradicting results and the the subsequent addition of rumination as a potential underlying mechanism (Raes et al., 2006) to explain them, hints that the picture is more complex than the affect regulation hypothesis (Williams, 1996) suggested. As an attempt to disentangle this complex picture, Williams et al. (2007) proposed the CaR-FA-X model, which we will turn next.

1.4 CaR-FA-X model

As stated above, Williams et al. (2007) structured the CaR-FA-X model around the conceptual framework of the Self-Memory System (Conway & Pleydell-Pearce, 2000). This hierarchical system of ABM has representations at different specificity levels. Life story is the broadest level of representation, followed by general themes,

life time periods (LTP) and general event knowledge (GEK). Event specific knowledge (ESK) is the most specific level and it corresponds to specific ABMs. Later Conway (2009) updated the SMS and introduced episodic elements (EEs) as the most specific level of the hierarchy. Together with conceptual frames, frames that contain information about the individual, this near experience elements form the simple episodic memories (SEM), which corresponds to ESKs.

According to Conway and Pleydell-Pearce, (2000), individuals can reach the SEMs using one of the two retrieval processes. In the first one, generative retrieval, cues will serve as the basis for memory search to enter the memory system. After the initiation of the search process, life time periods and then general event knowledge structures are activated. General event knowledge level is seen as the most common entry point into the memory system. Activation is then extended to SEMs which will end the search process. On the other hand, the second retrieval process, directive retrieval, is used when an internal or external cue grants immediate access to ESKs. Since the search process from the top to bottom level is skipped in directive retrieval, the need for executive control is less than the generative retrieval.

Conway and Pleydell-Pearce, (2000) suggested that if search process is terminated at a higher level during generative retrieval, only GEK can be reached, leading to OGMs. Individuals with MDD start the search process just like healthy participants do, but they stop searching before reaching SEMs. This abortion of the search process at a general level is called dysfaciliation and it is claimed to be the reason behind OGMs. Conway and Pleydell-Pearce (2000) claimed that dysfacilitation can be a form of passive avoidance, engaged to terminate the memory search before reaching the SEMs that are difficult to inhibit once they are accessed. Williams (1996) proposed the concept “mnemonic interlock” according to which

individuals with MDD are prone to being tied in repetitive overgeneral retrieval of ABMs, unable to go beyond the general levels. Moreover, Conway (2005) stated that during generative retrieval participants start the retrieval process by elaborating the cue and try to match it to some part of their current life. The initial elaboration of the cue then triggers the search within the ABM hierarchy. In some cases, a cue can lead directly to a specific memory skipping the generative retrieval. But most of the time the initial processing of the cue leads to further elaborations until a specific memory is retrieved. Conway (2005) suggested that in the individuals with MDD, impairments caused by MDD lead to problems in generative retrieval causing the process to terminate before reaching a specific memory.

In their seminal review of the OGM literature, Williams et al. (2007) proposed the CaR-FA-X model consisting of three mechanisms to account for the premature termination of the search process which in turn leads to OGMs; capture and rumination (CaR), functional avoidance (FA), and impaired executive control (X). The first mechanism, capture and rumination is defined as disrupting effects of ruminative processes that are active during retrieval. Capture leads to being stuck at more general levels of memory representation due to the activation of self-relevant conceptual information. For example, when a person is presented with the cue word "bad" this may lead her to think about a particular bad day she experienced The captured individual then becomes engaged in ruminative processes that involve focusing on the activated information in a repetitive, passive, and abstract way. The term rumination is typically used to refer capture and rumination mechanism as a in combination (Sumner, 2012). The second mechanism, functional avoidance, is argued to occur when retrieving ABMs in a general way to avoid the emotional impact and regulate affect. Finally, impaired executive control is defined as the

disrupting effect of impaired executive control on the retrieval from ABM. Due the impairment in EFs caused by depression, search processes of people with depression are terminated before they can reach a specific memory. Williams et al. proposed that OGM is a result of one or more of these three mechanisms. There is no hierarchy or priority among these mechanisms and they may result in OGMs either separately or in interaction.

In a recent review, Sumner (2012) investigated the mechanisms underlying OGM by evaluating the empirical evidence related to CaR-FA-X model. With this aim, Sumner reviewed 38 published articles investigating the relation between OGM and the mechanisms of the model. Studies examining the relationship between OGM and at least one of the mechanisms proposed by the CaR-FA-X model were included in the review. The results suggested a strong positive association between rumination and OGM. Investigation of the studies examining the relation between OGM and functional avoidance showed that, consistent with CaR-FA-X model, OGM is indeed a cognitive avoidance strategy showing higher levels of OGM positively associated with avoidance strategies. Finally, for the impaired executive control mechanism, all twelve studies included to the Sumner's (2012) review showed that impairments in either WM capacity, or one or more of the three main executive functions, shifting, updating and inhibition, are related to OGM.

Although the mechanisms of CaR-FA-X model were tested separately,the whole model was not tested until Sumner et al. (2014). Participants were young adults with or without a history of MDD. They collected measures of brooding, a dysfunctional form of rumination; functional avoidance. and verbal fluency for EF deficits. Sumner et al. (2014) found that brooding and verbal fluency contributed to OGM both separately and in interaction providing support for the capture and

rumination, and impaired executive functioning mechanisms. However, the nature of this interaction changed according to the group implying a moderation effect of brooding. For participants with an MDD history, lower verbal fluency led to OGM if the level of brooding was low. On the other hand, for participants without a history MDD, participants who had lower verbal fluency and high brooding scores recalled more OGMs. The latter finding seems to be consistent with the CAR-FA-X model, but the former does not; because according to the model if impairments in EF and rumination were to be related to each other, this relation would be a positive one rather than a negative one. In addition, participants with an MDD history and high brooding level showed lower levels of OGM, independent of their verbal fluency scores. No direct effect of avoidant coping style was found on the presence of OGM. As the authors noted one of the problematic issues was the fact that the depressive groups consisting participants with a history of MDD instead of participants currently diagnosed with MDD. However, one can argue that there are other problematic points in this study. First of all, only the brooding subcomponent of rumination was used. Second, only one EF task, the verbal fluency task COWAT, was used to assess all executive functions, although the literature on executive functions points out a more complex picture (e.g., Friedman, Miyake, Robinson, & Hewitt, 2011; Miyake et al., 2000).

Based on this background, the purpose of the present study is to explore the relationship between the two mechanisms supported by the literature more consistently for their roles in OGM: rumination and executive functions. To clarify the points stated above, a more comprehensive way to explore both of these functions will be taken.

1.5 Depression and executive functions

Miyake et al. (2000) explored executive functions by using a latent variable analysis in their seminal work. They focused on three executive functions: shifting, updating and inhibition. They demonstrated that these three processes are separable but moderately correlated with each other and participate differently in the higher executive functions such as decision-making and planning.

The first function, shifting, is characterized as switching back and forth between multiple tasks or mental actions (Monsell, 1996; as cited in Miyake et al., 2000). The second function, updating, is defined as "updating and monitoring of WM representations" (Miyake et al. 2000, p. 56). Updating function involves keeping track of the information in WM and editing the items according to their relevance to the task at hand. Finally, inhibition is defined as the capability of intentionally inhibiting unwanted stimuli that compete for the limited resources of the working memory system (e.g., Diamond, 2013).

Furthermore, Friedman and Miyake (2004) suggested that inhibition also has subcomponents. In a latent variable analysis, they identified three subcomponents: prepotent response inhibition, resistance to distractor interference, and resistance to proactive interference (PI). Prepotent response inhibition is defined as the ability to intentionally inhibit the automatic, dominant responses. Resistance to distractor interference is defined as the ability to resist irrelevant information from the external environment. Finally, Resistance to PI is defined as the ability to inhibit memory intrusions that are no longer relevant to the current task. Employing a structural equation modelling (SEM) method, Friedman and Miyake (2004) combined prepotent response inhibition and resistance to distractor interference as one subcomponent, and resistance to PI as another.

Impairments in EF are very fundamental for OGM (Williams et al., 2007). However, most of the studies claiming to investigate the effects of impairments in EF on OGM (e.g. Dagleish et al., 2007; Sumner et al., 2014) or on rumination (e.g. Ros, Latorne, & Serrano, 2009) either did not cover all EF mechanisms proposed by Miyake et al. (2000) or disregard their classification. Present study aims to clarify the relationship between EF and rumination, and their effect on OGM in depression. Therefore, for the purposes of this study, Miyake et al.'s (2000) conceptualization of EF and inhibition is very fundamental. The following section will explore the relationship between different executive functions as classified by Miyake et al. (2000) and depression, and how their interaction affects ABM.

Previous evidence suggests a positive relationship between EF deficits and depression (Austin et al., 2001). Depressed participants tend to have difficulties in updating, shifting and inhibition. Studies examining the effects of MDD on the updating function are mostly consistent with each other. Pelosi, Slade, Blumhardt and Sharma (2000) compared depressed participants and healthy controls in the Sternberg task and demonstrated that MDD participants were slower than the controls, and made more mistakes as the memory load increased. Moreover, their performance in the updating task was correlated with the longterm severity of MDD. In line with these findings, Harvey et al., (2004) showed that participants with MDD performed worse than controls regardless of the memory load in shifting, updating and inhibition. However, among the three EFs, only updating was related to number of hospitalizations and prognosis of the disease. Additionally, Rose and Ebmeier (2006) used the visual version of the n-back task in MDD patients and showed that they performed less accurately and slower than controls in all difficulty levels except

the 3-back level. Furthermore, analysis of reaction time data for n-back task revealed that MDD patients performed slower than controls in all difficulty levels.

In another study, Harvey et al., (2005) compared cerebral activity of MDD and control groups during n-back task using fMRI. Contradicting their earlier findings (Harvey et al., 2004), they found no differences between groups. However, it should be noted that, unlike their first study, MDD participants in this study were asked to complete a training session for n-back task and were only included if they pass a criterion of success determined based on the performance of healthy participants in the 2004 study. So, the MDD participants included in the study were ten successful participants out of twenty-two. Furthermore, fMRI results showed that although both MDD and control participants demonstrated bilateral activation in lateral prefrontal cortex (PFC), parietal cortex and anterior cingulate, activation in lateral PFC and anterior cingulate was greater for MDD participants. This suggested that, although it is possible for MDD participants to perform equally well as the controls, they need greater mental effort, to do so. This finding was later supported by Walsh et al. (2007).

Levens and Gotlib (2015) examined whether the nature of the impairment in the updating function differs based on the stimuli used. They compared recovered depressed and never depressed participants' updating performances for happy and sad faces. They found that recovered depressed participants were faster than controls while updating the happy faces and slower while updating sad faces. This result may suggest a decrease in the ability to maintain positive stimuli and disengage from negative stimuli, which may in turn affect the emotion regulation abilities of the depressed participants. Furthermore, impairments in the updating function were associated with increases in depressive symptoms when coupled with stress (Quinn

& Joorman, 2015). In a similar way, Pe, Brose, Gotlib and Kuppens (2016) also found that impairments in the updating function, especially in interaction with stress, increase depressive symptoms.

Individuals with depression also have significant difficulties in inhibition (e.g., Harvey et al., 2004), especially while inhibiting their attention away from emotionally negative stimuli (e.g., Joormann, Yoon, Zetsche, 2007). Using a set of different neuropsychological tests, Gohier et al., (2009) showed that in addition to their poor performance in all EF, MDD participants performed slower and made more errors than controls during inhibition tasks indicating impairment. However, it should be noted that some of the tasks used to assess inhibition in this study, the Modified Card Sorting Test (MCST) and Rule Shift Cards test (RCS) are similar to WCST, which is a shifting measure. Furthermore, Trail Making Test (TMT) and Verbal Fluency tasks, which are used to assess frontal lobe functions in this study, were used to assess shifting in other studies. (e.g. Harvey et al., 2004). Therefore, these findings did not only provide evidence for an impairment in inhibition but also for an impairment in the shifting function in support of Fossati, Amar, Raoux, Ergis and Allilaire's (1999) study, showing that individuals with depression showed deficits in shifting.

In line with these empirical evidence, Morris, Evans, Rao and Garber (2015), showed that there was a negative relation between shifting and inhibition, and depression: Higher inhibition and shifting scores were associated with a decrease in the depressive symptoms. Furthermore, Aker, Bø, Harmer, Stiles and Landro (2016) examined inhibition in participants in remission and participants without a history of depression. They found that participants in remission showed a significantly slower performance than the controls in the stop signal task but not in the Stroop task, both

of which are measures of prepotent response inhibition (Friedman & Miyake, 2004). Aker et al. (2016) suggested that this difference may be due to the more demanding nature of stop signal task and concluded that even in remission, depression impairs inhibition if high effortful control is needed.

Snyder (2013) explored the relation between MDD and EF in an extensive meta-analysis. One hundred and thirteen studies comparing healthy and MDD participants in at least one EF measure was included in the meta-analysis. Snyder found that MDD participants performed worse than healthy controls on all EF measures with similar effect sizes for shifting (d = .47, k = 69), updating (d = .57, k = 10) and inhibition (d = .58, k = 48). It was also revealed that the impairments in all three EF functions got worse as the depressive symptoms worsen. Furthermore, more recently, Snyder, Miyake and Hankin (2015) reviewed studies exploring EF deficits in psychopathologies and concluded that MDD significantly impairs shifting, updating and inhibition.

In the CaR-FA-X model (Williams et al., 2007), although EF deficits are one of the three main mechanisms resulting in OGM, the role different EFs play in OGMs was not clearly discussed. In CaR-FA-X model, executive functions were taken as a single unit rather than several diverse units correlated with each other as in Miyake et al. (2000). The studies summarized above demonstrated that impairments in shifting, updating and inhibition are positively related to depression. However, although impairments in all three EF functions are related to depression, the nature of the relation may be different. Results underline the importance of using multiple EF tasks tapping different EF functions to better understanding relationship between EFs and depression. Bredemeier, Warren, Berenbaum, Miller and Heller, (2016) showed that past and current Major Depressive Episode (MDE) scores were negatively

related shifting but not inhibition scores. On the other hand, current MDE scores were negatively related to inhibition scores but not shifting scores.

1.6 Executive functions and overgeneral memory

It has been shown that reduced EF capacity leads to an in increase in OGMs (Barnhofer, Crane, Spinhoven & Williams, 2007). In their comprehensive research composed of eight studies, Dalgleish et al. (2007) examined the effect of impaired executive function on OGM in healthy and subclinically depressed samples, as well as a clinical group with eating disorders. They used a wide range of tasks measuring executive control and fluid intelligence and showed that poorer performance measures of executive control and fluid intelligence task were associated with OGM regardless of the level of depressive symptoms. In addition to EF impairments, WM is also related to OGM in depression. Birch and Davidson (2007) investigated memory specificity in older depressed and older healthy individuals, as well as the relationship between OGM and WM capacity. As expected, while the depressed group recalled fewer specific memories compared to the non-depressed group, the two groups did not differ in the number of other types of memories generated (categorical, extended, omissions/repeated memories, and semantic associates). Furthermore, only the spatial span task, which measures visuo-spatial WM, had a strong positive correlation with the number of specific memories recalled, pointing to the importance of visuo-spatial memory for autobiographical remembering.

Yanes, Roberts, and Carlos (2008), in line with Dalgleish et al. (2007)'s assertion that the relationship between depression and OGM can largely be explained by deficits in executive functioning, conducted a study to investigate what aspects of executive function deficits account for this relationship. Specifically, they

hypothesized that the presence of OGMs might result from a failure to remember the instruction to generate specific memories as the task proceeded indicating WM impairments. Yanes et al. (2008) tested this hypothesis by asking half of the participants to recall the instruction set for the AMT in the middle of the task (i.e. after the presentation of 9 cue words) and then reminding the participants of the instructions by reading them out loud. They found that participants generated more OGMs as the AMT task proceed (i.e. with each trial/cue), and that participants who failed to recall the task instructions retrieved more OGMs. Furthermore, it was observed that reminding the instruction to the participants in the middle of the task resulted in a decrease in OGMs. The level of depressive symptomatology was associated with greater probability of OGMs, only in the second half of the task. These findings supported the postulation that a failure to maintain the task instructions while engaging in the task is highly related with the presence of OGM implicating a relation between WM capacity and OGM.

Another support for the role of executive functions in OGMs comes from aging studies. For instance, Piolino et al., (2010) compared the effects of impairments in shifting, updating and inhibition on OGM in young and old adults. They found that as the updating and inhibition scores get worse, the number of specific memories decreased with age. However, no effect of shifting was found. In another study, Haddad, Harmer, and Williams (2014) found that only women with depression histories, who have low executive functioning, produced increased number of categorical memories. The studies summarizes above provide evidence for the involvement of EF impairments in OGM.

1.7 Rumination

Rumination is defined as thinking passively and continuously about one's negative emotions, concentrating on signs of distress and its causes and consequences (Nolen –Hoeksama, 2000). Rumination seems to feed the thoughts of despair and negative judgments about the self and therefore it makes individuals easy targets for depression. In a study examining the relationship between MDD and rumination, Nolen –Hoeksama (2000) showed that rumination not only predicted the presence of depression but also the number of depressive episodes. The severity of depression and anxiety symptoms were also related to rumination.

Treynor, Gonzalez and Nolen –Hoeksama (2003) revealed in a factor analysis that the items in the Ruminative Responses Scale (RRS) loaded on to two factors. The first factor, reflection, is defined as an intentional involvement in cognitive problem solving to ease the distress. On the contrary, the second factor, brooding, is defined as thinking about one's present state in a pessimistic way and comparing it to an unfulfilled norm. The results of the study also revealed that reflection is related to more depression levels at the time of the test but less depression levels later, implying its adaptive nature. On the contrary, brooding was related to more depression both now and later. Furthermore, although women's scores were higher than men's in both factors, only the brooding factor was related to gender difference in depressive symptoms.

Nolen –Hoeksama, Wisco and Lyubomirsky (2008) stated that rumination affects problem solving negatively. It is also related to overgeneral thinking style and deficits in cognitive flexibility and switching attention from negative stimuli. Rumination, together with depression, is related to deficits in concentration and memory for neutral and non-emotional material. Pecher, Quaireau, Lemercier and

Cellier (2011) investigated the relation between depression, rumination and inattention and found that rumination adversely affects the ability to process information in the environment by making the individuals too focused on the content of their minds. Davis and Nolen – Hoeksama (2000) found that participants high compared to low on rumination performed worse in the WCST, which is highly correlated with shifting (Miyake et al. 2000). Furthermore, Joorman (2006) found that participants high on rumination were less likely to inhibit emotional distractors even when depression levels were controlled. Nolen –Hoeksama et al. (2008) stated that people high on rumination showed deficits in inhibiting irrelevant information and switching to relevant information. To sum up, these results seem to draw a clear picture: There is a strong relationship between rumination and deficits in executive functions in depression that is not fully investigated in CaR-Fa-X model and OGM literature. In the following section, this relation will be examined in detail.

1.8 Rumination and executive functions

Although the relationship between rumination and EF impairments in depression is well established, results regarding the direction of this relationship are not conclusive. According to Resource Allocation Theory (Watkins & Brown, 2002), rumination may be the underlying cause of executive function deficits in MDD since it uses the resources that would normally be used for capacity-demanding executive function tasks. Hence one can argue that in MDD patients who do not ruminate, deficits in executive functions will not be observed. However, while explaining the OGM phenomenon, the CaR-FA-X model did not point to any of the proposed mechanisms, namely capture and rumination, functional avoidance and impairments in EF as being more fundamental than the other (Williams et al., 2007). But the

resource allocation theory (Watkins and Brown, 2002), suggests that rumination is the reason underlying the impairments in executive functions in MDD, implicating a hierarchical relation between rumination, executive function impairments and OGM.

The second approach suggests that executive functions can be impaired in MDD regardless of the presence of rumination and it is the impairments in EF that lead to rumination (De Raedt & Koster, 2010; Joorman and Gotlib, 2008). OGM, executive functions and WM deficits are all observed in different psychiatric disorders such as acute stress disorder (e.g., Harvey, Bryant, & Dang, 1998; Qin, Hermans, van Marle, Luo, & Fernández, 2009), borderline personality disorder (e.g., Fertuck, Lenzenweger, Clarkin, Hoermann, & Stanley, 2006; Startup et al., 2001; Stevens, Burkhardt, Hautzinger, Schwarz, & Unckel, 2004), and Alzheimers disease (e.g., Morris & Baddeley, 1988; Moses, Culpin, Lowe, & McWilliam, 2004), whereas rumination is not. These findings suggest that rumination does not have to be the precursor of executive function and WM deficits and OGM. On contrary, it is suggested that because of the deficits in executive functions, people who are prone to depression cannot remove negative thoughts which in turn lead to rumination, increasing depressive symptoms (Joorman & Gotlib, 2008). Deficits in inhibition cause prolonged activation of negative content in WM, which in turn damages the ability to update the content of WM enabling irrelevant negative material to occupy WM.

There are several results supporting the resource allocation theory stating that deficits in executive functions in depression are caused by rumination and its demands on the limited executive capacity. Watkins and Brown (2002) compared MDD patients and non-depressed volunteers to test the hypotheses derived from this theory. All participants received either a rumination or distraction induction and were

subsequently asked to complete the random number generation task. The results showed that in MDD, rumination invades the resources participants need to complete the random number generation: MDD participants in rumination induction condition performed less randomly and reported more ruminative thoughts than the MDD participants in distraction induction condition. More importantly, no difference was found between the control and MDD participants in distraction induction condition.

Similarly, Levens, Muhtadie and Gotlib (2009) assigned individuals with MDD and healthy controls randomly to one of the two conditions: low or high interference. In low interference condition, participants were asked to complete only one task (recency-probe task or a tracking task); in high interference condition, however, participants were asked to perform two tasks (recency probe task and a tracking task) concurrently. In high interference condition, performance of the MDD participants was worse than controls. Groups did not differ in low interference condition. Moreover, there was a correlation between the performance and rumination scores for the MDD participants in high interference condition.

In a more recent study, Connoly et al., (2014) investigated the direction of the relation between rumination and executive functions in depression during adolescence in an analogue sample. The results revealed that adolescents' rumination levels at the first session predicted their performance in selective attention and attentional switching tasks one year later. Number of depressive symptoms at time 1 did not predict performance in executive function tasks at time 2. Furthermore, executive functioning at time 1 did not predict rumination and depression scores at time 2. However, it should be noted that none studies described above used tasks measuring inhibition, shifting, and updating functions of executive functions to

assess assessed all three EFs separately. Therefore, it is still an open question whether rumination predicts all executive functions.

There are also studies supporting the second hypothesis suggesting that EF impairments preceed rumination. Von Hippel, Vasey, Gonda and Stern (2008) found that in older adults, impairments in shifting and inhibition add to depressive symptoms by disrupting the capability to control ruminative thoughts. Supporting this view, Demeyer, De Lissnyder, Koster and De Raedt (2012) showed that impairments in executive functioning predicted depressive symptoms one year later, moderated by rumination. Rumination had no effect by itself. Similarly, Joorman et al., (2007) demonstrated that deficits in negative information inhibition is related to depression. Joorman (2006) showed that depressed individuals high in rumination have inhibition deficits suggesting the contribution of inhibition deficits to rumination. In line with these findings, De Lissnyder, Koster, Derakshan and De Raedt (2010) found a relation between inhibition and rumination especially for negative information.

In their review, Cohen, Daches, Mor and Henik (2014) proposed that problems in inhibition ability underlie the proneness to rumination. Being unable to inhibit negative material may lead the individuals to be trapped in rumination. On the other hand, if the individuals are good at inhibiting negative material, they are able to take another perspective and start reflecting on the same information from a different angle. Fawcett et al. (2015) tested this proposition by using an analogue group. They found that participants high in rumination had deficits in inhibition, particularly in the resistance to PI component.

Moreover, Zetche, D'Avanzato and Joorman (2012) examined whether depression and rumination is related to different components of inhibition differently.

They tested depressed participants' access and removal components. It should be noted that access component is defined as interference control of external irrelevant information consistent with Friedman and Miyake's (2004) resistance to distractor interference but the disengagement component, discarding no longer relevant information from WM, is more updating than inhibition. The authors indeed addressed this function as updating. The results showed that depressed participants performed worse than controls in interference control, but not in updating. On the other hand, there was a relation between rumination and updating, but interference control is not found to be relevant to rumination.

Furthermore, Whitmer and Banich (2007) investigated whether different kinds of rumination were affected by executive function deficits differently. They found that depressive rumination, which corresponds to brooding, was affected by the deficits in the ability to inhibit the previously relevant task sets. On the other hand, intellectual or angry rumination were affected by shifting, but not by inhibition. The inhibition assessed in this study corresponds to the interference control in Friedman and Miyake (2004). Taken together, these results showed the importance of assessing executive functions separately.

In summary, studies showed that rumination and deficits in EF are related phenomena (e.g. Joorman & Gotlib, 2008; Watkins & Brown, 2002). The Resource Allocation hypothesis (Watkins and Brown, 2002) claims that this relation is due to the demand rumination put on the limited capacity of the WM, which in turn causes impairments in EF. On the other hand, Joorman and Gotlib (2008) proposed a reverse relationship and stated that deficits in the EF cause rumination. However data regarding the direction of this relationship is not conclusive and further studies are needed to reach a better understanding of the nature of this relationship.

1.9 Rumination and overgeneral memory

Williams et al. (2007) argued that there might be a relation between rumination and OGM. Supporting this argument, Watkins, Teasdale and Williams (2000) showed that using distraction or rumination inductions, OGMs could be increased in MDD participants. Watkins and Teasdale (2001) stated that high levels of rumination may be the underlying reason behind the OGM in depression.

Raes et al. (2006) investigated whether OGM is a predictor of depression and how rumination affects this relationship in MDDs. Participants completed AMT, and rumination scales twice, second one being 7 months after the first one. Number of specific memories retrieved in response to negative words at time 1 was a predictor of depression level at time 2. However, if rumination was controlled for, this effect vanished, suggesting the predictive value of reduced ABM specificity for negative words was in part due to rumination.

After the proposal of the CaR-FA-X model (Williams et al., 2007), the suggested role of rumination in OGM became clearer. Studies showed that brooding component, but not reflection component, of rumination is particularly related to OGM (e.g., Sumner, 2012; Sumner, Griffith, Mineka, 2010; Sumner et al., 2014). Romero, Vasquez and Sanchez (2014) replicated these findings in dysphoric participants asking the important ABMs.

Kong, He, Auerbach, McWhinnie and Xiao (2015) examined the relation among OGM, rumination and depression in an analog sample. They found that individuals high on rumination produced more OGMs and they also had more severe depressive symptoms. Furthermore, the increase in OGMs intensified these participants' depressive symptoms, which suggests that OGM might be a vulnerability factor for depression. On the other hand, Ricarte, Hernandez, Latorre,

Danion and Berna (2014) showed that although brooding was related to depressive symptoms in schizophrenic participants. However, neither brooding nor depression were related to OGM. The authors interpreted this finding as an indication of the contribution of other factors to this relationship.

Supporting the ideas stated above, Barnhofer, Jong-Meyer, Kleinspass and Nikesh (2002) found that participants with MDD were more likely to produce OGMs consecutively than controls only if they start reminiscing with a categorical memory. This finding provides support for "mnemonic interlock" by showing the individuals with MDDs tendency to be tied in repetitive overgeneral retrieval of ABMs. However, if they started with a specific memory, they performed as well as control participants.

In a recent study, Haque, Juliana, Khan and Hasking, (2014) asked MDDs to retrieve ABMs in response to 15 cue words and then coded the narratives as LTP, GEK, ESK, thought (beliefs and opinions) and, mixed (thoughts and general facts together). They found that MDDs retrieved fewer ABMs, although retrieval process was faster, which might indicate that MDD patients are stuck at the GEK level (Crane, Goddard & Pring, 2009). Additionally, their ABM narratives were shorter, more negative, and less specific. Both MDDs and non-depressed participants started the search process at LTP level but unlike controls, MDDs stopped the search process at GEK level and did not continue to ESK.

1.10 Cue Type and overgeneral memory

It has been suggested that using different cueing techniques may lead to different retrieval processes. For instance, Pillemer (1998), and Singer and Salovey (1993), suggested that asking participants to retrieve ABM by using important events as cues

leads to perceptually rich representations implying access to more specific ABMs. Similarly, Rubin and Schulkind (1997) as well as Berntsen and Bohn (2010) stated that memories of important events were rated higher on imagery, vividness, and they are rehearsed more than the memories elicited by cue words.

Recently, Uzer and Brown (2017) investigated the effects of cue type on retrieval processes in two studies. In study 1, they asked the participants to recall ABMs in response to specific and individuated versus generic cues. In study 2, participants were asked to retrieve ABMs in response to cue words they themselves generated 3 months prior to the testing phase. Results of the both studies showed that participants rely on directive retrieval for the personal cues but not for the generic cues.

Studies showed that using specific versus categorical cues or alternating between them affect the presence of OGMs in non-patient populations (Dritschel, Beltsos, & McClintock, 2014). Furthermore, Wessel et al., (2014) showed that using different types of cues (affective vs. self-discrepant) in AMT task changes the way OGMs were affected by the different components of CaR-FA-X model in women with depression histories. OGMs produced for affective cues, but not for self-discrepant cues, were related to FA, whereas performance for self-discrepant cues was related to rumination. Together, these results underline the importance of using different cues to elicit ABM in understanding the mechanisms underlying OGMs.

Koppel and Berntsen, (2015) suggested that using important memories as cues will lead to directive retrieval and using cue words will lead to generative retrieval. Romero et al. (2014) asked participants to remember five important memories from different periods of their lives to examine the effects on rumination on OGM in a dysphoric group. They found that, dysphoric participants produced

more categorical and less specific memories than non-dysphoric participants, in line with the studies using AMT suggesting that important memories were not spared from being overgeneral. On the other hand, Eisma et al., (2015) investigated OGMs in a depressive group showing complicated grief symptoms. They coded the memories produced by the participants as loss related versus non-related, and found that higher levels of depression, rumination and grief symptoms are related to higher number of OGMs. However, for the grief related memories, no such relation was found implying that memories that were not as important were more prone to become overgeneral.

1.11 The goal of the study

Present study has three main goals. First goal of the present study is to examine whether different EFs are affected by depression differently. Evidence shows that there are deficits in updating (Harvey et al. 2004; Harvey et al., 2005), and shifting (Harvey et al., 2004; Rose & Ebmeier, 2006) in MDD. On the other hand, data regarding inhibition have not been as consistent. Contradictory results have been found in Stroop task performance, which is a commonly used measure of inhibition (Gohier et al., 2009; Harvey et al., 2004; Sumner, Griffith, Mineka, 2012). However, Friedman and Miyake (2004) used Stroop task only as a measure of prepotent response inhibition. To clear out this conflicting set of results, the present study aims to examine the EF deficits in depression using measures assessing shifting, updating and two subcomponents of inhibition and inspect whether they are affected by depression differently.

The second aim of the present study is to clarify the nature of the relationship between rumination and EF deficits. In their CaR-FA-X model, Williams et al.

(2007) proposed that capture and rumination, functional avoidance, and impaired executive functions are the three mechanisms affecting the formation of OGM, and that in depression, the presence of one or more of the three mechanisms results in OGM. CaR-FA-X model assumes that the three mechanisms can both act independently or in interaction with each other. Furthermore, none of the mechanisms were defined as more important than the other and there is not a hierarchical relationship between them.

However, literature on rumination and EF deficits suggests a causal relationship between them (e.g. Joorman & Gotlib, 2008; Watkins & Brown, 2002). According to Resource Allocation hypothesis (Watkins & Brown, 2002), rumination, by putting demands on the limited capacity of the WM, causes impairments in EF. This hypothesis was supported by various studies (e.g., Connoly et al., 2014; Levens et al., 2009). On the other hand, Joorman and Gotlib (2008) proposed that deficits in the EF underlie rumination. In sum, while the former set of findings postulate rumination as the primary cause for WM deficits, the latter set of findings interpret WM deficits as causing rumination.

Based on the current findings reviewed, a modification in the CaR-FA-X model is proposed in the present study. Following Joorman and Gotlib's (2008) view stating that EF deficits lead to rumination in depression, the proposed model postulates that, despite having a direct effect on the formation of OGM, deficits in executive functions also have an indirect influence on OGM through their contribution to the formation of rumination. In other words, we state that EF deficits would have a direct effect and an indirect effect via rumination on memory specificity, but the effect of rumination on memory specificity would be depended on EF deficits. We propose that this modification in the model will contribute to the

understanding of OGM in other psychiatric disorders, as well as in non-clinical samples

Finally, present study aims to examine the effects of cue type on memory specificity in depression. By using cues that would trigger directive (important memories) versus generative retrieval (cue words) processes, the present study aims explore the differences between the retrieval processes of high and low BDI participants in response to different cues and the effects of EF and rumination during different retrieval processes. Previous studies mostly examined effects of cue type by using self-relevant/irrelevant cues (Wessel et al., 2014; Schoofs, Hermans, Raes, 2012) or individual cues (Uzer; 2016; Uzer & Brown, 2017). However such cues mandates the use of different cues for different participants. Instead, in the present study, same cues were used for all participants to trigger different retrieval processes. To our knowledge, this is the first study that explored different retrieval processes in OGM using the same cues for all participants.

Hypotheses of the present study are as follows:

1. Participants with high BDI are expected to perform worse than participants with low BDI in all EF measures.

2. Participants with high BDI are expected to score higher on RRS and show higher brooding style rumination than participants with low BDI.

3. Both high and low BDI participants are expected to produce more specific memories for important memories than for cue words and participants with high BDI will produce less specific memories than participants with low BDI both for word-cued.

4. For the word-cued memories, only for the high BDI group, participants who are impaired in updating, shifting and resistance to PI subcomponent of

inhibition are expected to be higher on brooding and produce less specific memories than participants who are not.

CHAPTER 2

METHOD

2.1 Participants

A battery was sent to 861 students taking introductory psychology courses. Students were asked to fill out BDI-II, and demographic questions along with two scales that were irrelevant for the study to hide the selection criteria. Four-hundred eighty students participated the battery were awarded with 0.5 credits. After excluding the participants using antidepressants, 202 participants who met the preset criteria of having a BDI score smaller than 6 (low BDI group, 91 students) or bigger than 20 (high BDI group, 111 students) were invited to participate to the study. One-hundred and forty-four students participated to the first session and 135 students to the second session. The final selection of the participants was made after comparing their first (battery) and second (second session) BDI scores. Only participants who met the criteria in both times were included to the study. As a result, the final set of participants consisted of 51 low BDI (23 women; M_{age} = 19.62, SD_{age} = 1.05) and 45 high BDI (30 women; M_{age} = 19.06, SD_{age} = 3.05) participants.

2.2 Inhibition measures

2.2.1 Eriksen flanker task

Eriksen Flanker task was prepared using Psychopy version 1.85.0 (Peirce, 2009). The task was to identify a target letters that were presented either alone or with response-incompatible letters flanking it (Eriksen & Eriksen, 1974). Participants were asked to press a button as quickly and as accurate as possible to the identity of a centrally presented letter, ignoring any other letters that flanked the target letter. For the letter

H, participants pressed the right arrow key, and for the letter S press the left arrow key. There were three flanker conditions: (a) base condition (H), (S); (b) same as target (HHHHH), (SSSSS); (c) response incompatible (SSSHSSS), (HHSHH). The letters were in capital, 22-point, bold, Courier font, and the spatial separation of the letters were the same as the spacing of letters in a printed word. Each trial started with a 1,000-ms blank screen followed by a 500-ms fixation point. The stimuli, printed in black on a gray background, were presented on the screen until participant's response. The task consisted of 120 trials in total (20 trials of each type). There were 36 practice trials with all conditions represented. The six trial types were mixed in a fixed random order so that the same condition was not presented on more than 3 successive trials. There were no negative priming trials in which the current target letter was the flanker noise letter to be ignored one trial prior. The difference in number of correct answers in the response-incompatible condition versus the no-noise condition were used as the primary dependent measure.

2.2.2 AB-AC-AD Task

To create AB-AC-AD task, Psychopy version 1.85.0 (Peirce, 2009) was used. In AB–AC–AD, participants first learned a list of cue–target word pairs to a criterion, and they were asked to learn a new list of targets that were paired with the same cues (Rosen & Engle, 1998). In the present study a modified version used by Friedman and Miyake (2004) which involves three 12-item lists of the form AB–AC–AD were used. To maximize interference, the cue word and the three response words paired with that cue belonged to the same category. Each set of three lists was constructed by selecting 12 quadruplets from Peynircioğlu's (1988) category norms. Each category had a set size of at least 30 words. The cue word was the most frequent

exemplar for each category. The following three exemplars were randomly used as response words. For instance, the response words for the cue word CARROT were pea, potato and corn for the AB, AC and AD lists respectively.

For each list, same procedure was used: For the study phase, each pair was shown on the computer screen for 2 s. For the testing phase, participants saw the cue word on the screen and were asked to write the correct word. If the participant wrote the correct word, a correct feedback was given. However, if participants could not write the correct response she saw a feedback stating her response was incorrect and the correct response. The testing phase continued until participants could correctly respond to each cue three times. The pairs were tested and retested in the same order. However, if a cue received the correct response three times, it was dropped from the list. When the participants achieved recalling each pair three times, they saw each pair for two seconds one last time before they moved on the next list. Three scores were calculated to be used as participants' scores. First of all, the difference among the number of trials needed to learn the pairs on each list were calculated. The first two scores were difference between the number of trials between list 2 and 3, and 1 and 3. The third score was the proportion of perseverance errors made in all lists in AB-AC-AD task. To calculate this score the times a participant used the correct answer from the previous list instead of the correct answer from current list were counted for both lists two and three. The sum was used as the perseverance error score.

2.3 Shifting task

2.3.1 The Berg's card sorting test - 64 card

For shifting, Berg's Card Sorting task (Berg, 1948) was conducted using Psychology Experiment Building Language 2 –PEBL2 (Mueller & Piper, 2014). BCST measures how well people can adapt to the changing rules (Heaton, Chelune, Talley, Kay & Curtis, 1993). Participants were shown four key cards with varying stimulus characteristics (e.g., yellow stars, green triangle, blue crosses, and red circles). Participants were asked to match the cards they draw from the response deck to one of the key cards according to different criteria that are color, shape, or number of the shapes on each card. The only feedback participants were given is whether they classified the card correctly or not. The classification rule changed in every 10 cards. The task continued until the participant sorts all the cards correctly or ran out of cards. Primary dependent measures were proportions of correct answers, perseverance errors and non-perseverance errors.

2.4 Updating task

2.4.1 N-back task

In N-back task (Cohen et al., 1997) participants were shown a sequence letters one-by-one. For each stimulus, they were asked to decide whether it was the same as the one shown N trials ago. The present study used 1-back and 2-back versions and both consisted of 48 trials. Letters (B, C, D, F, G, H, K, P) were presented one by one for 1 second in every two seconds. Participants were asked to push buttons on the keyboard to answer the question whether the present letter matches the letter n-trials ago (left arrow key for yes, right arrow key for no). Proportion of correct answers were calculated.

2.5 Autobiographical memory test (AMT)

In AMT, participants were asked to retrieve a specific ABM to a cue word (Williams & Broadbent, 1986). In the test, there were 10 cue words referring to five positive (happy, surprised, interested, successful and safe) and five negative emotions (clumsy, angry, sorry, hurt, and lonely). The memories triggered by the cue words were then coded as specific (a unique event that occurred within 24 hours), general (all memories besides specific ones) or as non-memories. AMT had two main measures: number of specific and categoric memories recalled. Barnabe, Whitehead, Pilon, Arsenault-Lapierre and Chertkow (2012) found that the memory impairments were evident after the second memory if cue words are used to retrieve memories. Therefore, in the present study only two positive and two negative cue words were presented to elicit ABMs. For details of the instructions please see Appendix A.

2.6 Short version of the ruminative response scale (RRS)

RRS consists 10 items from the original list of 22 that was developed by Nolen-Hoeksema and Morrow (1991). Participants are asked to answer each question on a 4-point Likert scale, ranging from 1 (“almost never”) to 4 (almost always”) (Treynor et al., 2003). RRS consist of two subscales: reflection and brooding. RRS was translated into Turkish by Erdur-Baker and Bugay (2009) and it is shown to be reliable and valid. Turkish version of the short version of RRS is presented in Appendix B.

2.7 State–trait anxiety inventory

STAI measures and individuals anxiety level at the time of the test and in general (Spielberger, Gorsuch, Luschene, Vagg, & Jacobs, 1983). It consists of 40 Likert-

type items. Twenty of the items were about state (see Appendix C) and 20 of them were about trait anxiety (see Appendix D). The Turkish version has been shown to be reliable and valid (Öner & LeCompte, 1985).

2.8 Beck depression inventory - II

The BDI-II is a measure of depression symptom severity in the last 2 weeks consisting of 21-self report items with a scale ranging from 0 to 3 (Beck, Steer, & Brown, 1996). Kapci, Uslu, Turkcapar and Karaoglan (2008) showed the Turkish version to be valid and reliable. Turkish version of BDI-II is presented in Appendix E.

2.9 Demographic information

Participants were asked to complete questions regarding their age, gender, occupation and other general personal information. Demographic questions can be seen in Appendix F.

2.10 Procedure

Participants were asked to take part in a two-part study about how executive functions affect memory processes. Prior to participation, written consents were obtained from interested participants. In the first session of the study, participants completed BCST, N-Back task, Eriksen Flanker Task and AB-AC-AD test. All participants received the BCST task first and the order of the remaining tasks was determined using Latin-square. After the participants completed the EF tasks, they rated 10 words (including the four words chosen as cue words for the second part of the study) for valence. Instructions for valence ratings were presented in Appendix F.

Finally, participants will be asked to complete State Anxiety Inventory (Spielberger et al., 1983).

The second session of the study was conducted exactly one week later. In the second session, participants were asked to retrieve ABMs in response to two positive (mutlu, kararlı) and two negative (kötü, sıkıntı) words. They were shown the words on screen and asked to write a memory that is triggered by the cue word in as much detail as possible. In addition to cue words, participants were asked to write down in detail 2 of their most important memories for Study 2. Collection of memories by using cue words or by asking most important memories were counterbalanced. After the memory collection phase, they rated the valence of the memories. After that, participants completed STAI, BDI, demographic questions, and questions regarding their medical history. All questionnaires were administrated using Google forms and were run on a personal computer in the cognitive processes lab. The study already received ethics approval by the Bogaziçi University Ethics Board.

2.11 Coding

For the purposes of the study, all memories recalled by the participants were coded for specificity as instructed in AMT (Williams & Broadbent, 1986). Memories about events that happened at a specific time and place within one day were coded as specific. If the event lasted more than one day, it was coded as extended. Summaries of events were coded as categorical. If there is no personal memory but only semantic information, it was coded as semantic associates. All memories were coded two trained coders one of which was blind to the hypotheses.

CHAPTER 3

RESULTS

In this study, participants completed executive function tasks, rumination, state and trait anxiety measures in session 1. They reported important memories and memories in response to cue words in session 2 and after the memories they completed State Anxiety Inventory and BDI for the second time. In this section, I first present the analysis for gender differences and anxiety to evaluate the effects of possible confounding variables. High and low BDI groups are compared for rumination (Hypothesis 1), EF measures (Hypothesis 2), and memory specificity (Hypothesis 3). The main aim of the present study was to examine whether shifting, updating and inhibition affect the retrieval of ABMs differently and the role rumination plays in these relationships. Therefore, lastly, I present findings regarding relationships between EF, brooding and ABM (Hypothesis 4).

3.1 Gender differences

Given the well-documented relationship between gender and several variables of interest in the present study [e.g., depression (Picinelli & Wilkinson, 2000), rumination (Johnson & Whisman, 2013)], low and high BDI groups were compared for gender separately for all variables (e.g. anxiety scores, updating scores, memory specificity etc.). For the low BDI group, the total rumination scores of the female participants were higher than the male participants, $t(49) = 2.047$, $p = .046$, $d = .58$. There was also a trend towards female participants having higher reflection scores than male participants, $t(49) = 1.191$, $p = .056$, $d = .55$. Table 1 demonstrates Means and SDs of the BDI, STAI and RRS for each group according to gender.

Table 1. Means, SDs of BDI, STAI and RRS According to Group and Gender

	Low BDI Group				High BDI Group			
	Female		Male		Female		Male	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
BDI 1st	3.91	1.73	2.79	1.99	31.57	6.62	28.53	7.14
BDI 2nd	4.35	2.77	3.36	2.68	30.37	7.84	31.53	11.15
State Anxiety 1st	35.26	5.69	34.79	3.87	47.23	7.61	48.33	10.00
State Anxiety 2nd	34.48	6.43	33.00	4.15	49.63	7.75	50.87	9.09
Trait Anxiety	31.96	15.79	33.21	10.10	51.37	16.25	60.40	7.74
Total RRS Score	19.91	3.93	17.79	3.49	27.73	4.91	27.47	4.82
Reflection Score	10.39	3.07	8.86	2.52	13.60	3.19	13.47	2.77
Brooding Score	9.52	1.56	8.93	1.92	14.13	2.39	14.00	2.90

Furthermore, for the high BDI group, the trait anxiety scores of females were lower than males, $t(43) = 2.032$, $p = .048$, $d = .64$. Besides these three scores, gender was not related to other study variables for either low BDI (all ps > .081) or the high BDI (all ps > .095) groups. Given these results, data were collapsed except the comparisons of total rumination, reflection and trait anxiety scores across genders for the rest of the analyses examining group differences. However, gender was included in the first step of all regression models examining the relationships among EF, rumination and memory specificity because of its effects on rumination.

3.2 State-trait anxiety inventory

Given that anxiety has a high comorbidity with depression (Brady & Kendall, 1992), to see how anxiety affects the result of our study, state anxiety scores of the participants were collected at both first and second sessions and trait anxiety scores were collected at the first session. To see whether groups differed from each other in terms of state anxiety, a 2 (Group: high BDI vs. low BDI) x 2 (Session: 1 vs. 2) mixed design ANOVA was conducted. The results showed for state anxiety scores there was no main effect of group, $p = .386$. For both sessions, high BDI group (M_{s1}

= 47.60, SD_{s1} = 8.39; M_{s2} = 50.04, SD_{s2} = 8.14) scored higher on state anxiety than the low BDI group (M_{s1} = 35.00, SD_{s1} = 4.73; M_{s2} = 33.67, SD_{s2} = 5.30), F (1, 94) = 140.74, $p < .001$, MSe= 10037.178, $\eta_p^2 = .600$. There was also an interaction between session and group, F (1, 94) = 8.781, $p < .014$, MSe= 170.590, $\eta_p^2 = .085$, showing that the state anxiety scores of the high BDI group increased from the first to the second session [$t(44) = 2.211$, $p = .032$, d= .329], whereas for the low BDI group the scores remained the same ($p = .061$, $d = .268$).

Analyses examining the effects of gender showed that there was an effect of gender on trait anxiety scores of the high BDI group. Therefore while examining the groups differences, a 2 (Gender: male vs. female) x 2 (Group: high BDI vs. low BDI) between subjects ANOVA was conducted. Results revealed a group effect on trait anxiety scores. Participants in the high BDI group (M = 54.37, SD = 14.55) scored higher than the participants in the low BDI group (M = 32.64, SD = 12.85), F (1, 92) = 66.57, $p < .001$, MSe= 182.003, $\eta_p^2 = .425$. There was no effect of gender, F (1, 92) = 3.247, $p = .075$, MSe= 182.003, $\eta_p^2 = .034$ and no interaction F (1, 92) = 1.854, p = .177, MSe= 182.003, $\eta_p^2 = .020$.

3.3 Rumination

One of the aims of the present study was to see whether rumination was affected differently from depression. With an aim to examine this relationship, hypothesis 1 stated that participants with high BDI are expected to score higher on rumination, reflection and brooding scores than participants with low BDI. To test this hypothesis two groups were compared first for total RRS scores. Since preliminary analyses showed a gender difference in rumination scores of the low BDI group, a 2 (Gender: male vs. female) x 2 (Group: high BDI vs. low BDI between subjects ANOVA was

conducted. The results revealed a main effect of group for the total rumination score. As expected, high BDI group (M = 27.64, SD = 4.82) had higher total rumination scores than the low BDI group (M = 18.75, SD = 3.81), F (1, 92) = 92.93, p < .001, MSe= 18.39, η_p^2 = .503. There was no effect of gender F (1, 92) = 1.739, p = .191, MSe= 18.39, η_p^2 = .019 and no interaction F (1, 92) = 1.050, p = .308, MSe= 18.39, η_p^2 = .011.

In line with our hypothesis high BDI group (M = 14.09, SD = 2.54) got higher brooding scores than the low BDI group (M = 9.20, SD = .78), F (1, 92) = 110.14, p < .001, MSe= 4.75, η_p^2 = .545. Neither an effect of gender [F (1, 92) = .620, p = .433, MSe= 4.75, η_p^2 = .007] nor an interaction [F (1, 92) = .248, p = 619, MSe= 4.75, η_p^2 = .003] was found.

Similar results were found for the reflection subcomponent. The scores of the high BDI group (M = 13.56, SD = 3.03) was higher than low BDI group (M = 9.55, SD = 2.86) in reflection, F (1, 92) = 40.14, p < .001, MSe= 8.50, η_p^2 = .304. There was no effect of gender F (1, 92) = 1.826, p = .180, MSe= 8.50, η_p^2 = .019, and no interaction F (1, 92) = 1.289, p = .259, MSe= 8.50, η_p^2 = .014.

3.4 EF measures

To see whether there were any individuals with extreme responses for base EF scores, we conducted outlier analyses using proportion of correct answers in 1-back for n-back task, proportion of non-perseverance errors for the BCST task, proportion of correct answers in the base condition for the Eriksen Flanker task and number of trials used to learn List 1 for AB-AC-AD task. For the outlier analysis, the distance between the individual scores and the mean of all participants in terms of SDs were calculated. If the distance between the individual score and the mean of all

participants was higher than 3 SDs for the base condition, that participant's all scores for that task was excluded from the analysis. For example, if a participant's score for proportion of non-perseverance errors for the BCST task was 3 SDs higher than the total mean, his/her other BCST scores were also excluded from the analyses. After the outlier analysis, we excluded scores of 6 participants (2 from low BDI, 4 from high BDI groups) for the n-back task, 3 participants (0 from low BDI, 3 from high BDI groups) for the BCST, 3 participants (1 from low BDI, 2 from high BDI groups) for the Eriksen Flanker task and 2 participants (1 from low BDI, 1 from high BDI groups) for the AB-AC-AD task.

Hypothesis 2 predicted that for all EF measures, participants in the high BDI group would perform worse than participants in the low BDI group. To test this hypothesis, we compared the updating, shifting and inhibition scores of low and high BDI participants. Summary of results and means and SDs of EF measures are presented in Table 2.

3.4.1 Updating

To explore whether updating ability is affected by depression, participants' performances on 1-back and 2-back tasks were compared. For both tasks, proportion of correct answers were used as updating measures as it is common in the literature (e.g. Harvey et al., 2004). Since there was minimum processing load in the 1-back task, we did not expect groups to be different from each other for the 1 back task. As expected performances of low and high BDI group for the 1-back task were not significantly different from each other ($p > .088$). The results showed that for the updating ability, groups were different from each other only for the proportion of correct answers in the 2-back task, $t\ (88) = 2.697$, $p = .008$, $d = .58$, low BDI group

producing more correct answers (M = .73, SD = .16) than the high BDI group (M = .63, SD = .20), in line with our hypothesis.

Table 2. Summary of Results and Means and SDs of EF Measures

	Low BDI Group		High BDI Group				
	Mean	SD	Mean	SD	*t*	*p*	*d*
Eriksen Flanker Task							
Congruent Correct-Incorrect	39.25	.93	39.42	.89	.92	.360	.190
Congruent Correct-Incorrect RT	605.02	118.75	616.57	151.72	.41	.683	.084
Incongruent Correct-Incorrect	36.55	2.56	37.56	1.42	4.55	.020	.480
Incongruent Correct-Incorrect RT	90.74	64.39	183.95	120.17	4.55	.001	.966
N-Back							
1-back Proportion of Correct	.94	.05	.91	.09	1.56	.124	.450
2-back Proportion of Correct	.73	.16	.63	.20	2.70	.008	.580
Berg's Card Sorting Task							
Total Correct	48.28	7.06	44.24	9.13	2.42	.017	.500
Categories Completed	3.58	1.13	2.82	1.21	3.16	.002	.670
Perseverance Error	8.48	3.85	8.89	5.06	-.45	.657	.090
Non-perseverance error	7.24	5.34	10.87	9.88	-2.19	.032	.460
AB-AC-AD Task							
L2-L1	.26	.94	.09	.87	.91	.363	.190
L3-L1	.26	.75	.16	.98	.59	.558	.120
L3-L2	.00	.73	.07	.72	-.45	.655	.100
Prop. perseverance errors	.17	.20	.24	.24	-1.52	.133	.320
AMT							
Prop. specific cued-memories	.52	.28	.40	.28	2.14	.035	.440
Prop. specific important memories	.64	.37	.57	.37	.92	.358	.202

3.4.2 Shifting

Shifting ability was measured using BCST. Four scores were used as shifting measures: total number of correct answers, perseverance errors, non-perseverance errors and categories completed. In line with our hypothesis, high BDI group performed worse than the low BDI group except for the number of perseverance errors (p = .657). The total number of correct answers were lower for the high BDI

group (M = 44.24, SD = 9.13) than the low BDI group (M = 48.28, SD = 7.06), t (93) = 2.423, p = .017, d = .50. The high BDI group also completed fewer categories (M = 2.82, SD = 1.21) than the low BDI (M = 3.58, SD = 1.13), t (93) = 3.159, p = .002, d = .65. Finally, the number of non-perseverance errors were higher for the high BDI group (M = 10.87, SD = 9.88) than the low BDI group (M = 7.24, SD = 5.34), t (66.11) = 2.191, p = .032, d = .46.

3.4.3 Inhibition.

Participant in the high BDI group were expected to perform worse on inhibition measures. Two subcomponents of inhibition were measured: resistance to distractor with Eriksen Flanker task and resistance to PI with AB-AC-AD Task. For the Eriksen Flanker task, 2 different scores were compared. Percentage of correct responses for congruent trials was used as a baseline and the groups were not expected to be different from each other in this measure. Results were in line with this expectation. Groups were not different from each other for the congruent trials for percentage of correct responses (p = .360). To explore whether depression affects the resistance to distractor ability, the difference between the proportions correct responses for congruent and incongruent trials was compared. In this analysis, since the Levene's test for equality of variances was significant (p = .037) a correction was used. Results showed that the proportion of correct differences were higher for the high BDI group (M = 37.55, SD = 1.42) the low BDI group (M = 36.55, SD = 2.56), t (76.78) = 2.371, p = .020, d = .48. These results support hypothesis two which predict a deficit in the inhibition abilities of the high BDI participants.

To test whether the AB-AC-AD task worked, number of trials required to learn list 1, list 2 and list 3 were compared for both groups. Since the Mauchly's Test

of Sphericity was significant (p = .045) a Greenhouse-Geisser correction was used. Results of repeated measures ANOVA showed that number of trials required to learn a list increased from list 1 (M = 3.87, SD = .77) to list 2 (M = 4.05, SD = .61) and list 3 (M = 4.08, SD = .64), F(1.87,175.75) = 3.51, p = .035, MSE= .373, η_p^2 < .036. For the resistance of PI subcomponent of inhibition 4 scores were compared: difference between number of trials required to learn list 1 and list 2, list 1 and list 3, list 2 and list 3. However, contrary to our hypothesis, for the resistance to PI subcomponent, groups did not differ from each other in any of the measures (all ps > .091).

3.5 Memory specificity

All memories recalled by the participants were coded for specificity as described in AMT (Williams & Broadbent, 1986) by two independent coders and the kappa for intercoder reliability was .81, a score classified as excellent agreement (Hunt, 1985). Disagreements were solved through discussion.

Since the collection of the word-cued and important memories were counterbalanced, a within subjects t-test were conducted to see whether memory order had an effect on memory specificity. The results showed that task order had no effect on memory specificity of neither cued nor important memories for neither groups (all ps > .800). For the high BDI group, proportion of specific memories triggered by cue words were .40 both when cue words were presented first or important memories were asked first. For the low BDI group proportion of specific memories triggered by cue words were .44 when cue words were presented first and .56 when or important memories were asked first. For the important memories, the proportion of specific memories were .58 for both when cue words were presented first or second for the high BDI group. For the low BDI group, proportion of

important specific memories were .75 when cues were presented first and .59 when important memories were asked first. Therefore memory order was not taken into account for the rest of the analyses. All analyses were conducted two-tailed.

Since participants were asked to remember memories in response to positive and negative cue words and valence is known to affect memory (e.g. Libkuman, Stabler, & Otani, 2004); before pursuing further analysis, memories produced in response to negative and positive cue words were compared in terms of memory specificity for both groups. For the proportion of specific memories a 2 x 2 (valence x BDI group) mixed design ANOVA was conducted. There was only a effect of depression on memory specificity: proportion of specific memories was lower for the high BDI group (M = .400, SD = .28) than the low BDI group (M = .525, SD = .28), $F(1,94) = 4.595$, $p = .035$, $MSE = 2.965$, $\eta_p^2 = .047$, supporting hypothesis 3. Furthermore, there was no effect of valence $F(1,94) = .055$, $p = .902$, $MSE = .303$, $\eta_p^2 < .000$and there was no interaction $F(1,94) = .055$, $p = .902$, $MSE = .303$, $\eta_p^2 < .000$, (see Table 3). Based on these findings, proportion of specific memories produced for positive and negative cues were collapsed for further analyses.

Table 3. Means and SDs of Proportion of Specific Memories According to Valence for Both Groups

Proportion of Memories				
	Positive		Negative	
	Mean	SD	Mean	SD
Low BDI	.52	.33	.53	.37
High BDI	.40	.29	.40	.38

According to hypothesis 3, for the cue words, participants in the high BDI group were expected to produce less specific memories than participants with low

BDI in both conditions. However, both high and low BDI participants are expected to produce more specific memories for important memories than for cue words. To test this hypothesis, a 2 (Group: high BDI vs. low BDI) x 2 (Cue type: Important vs. Cued) mixed design ANOVA was conducted. In line with hypothesis 3, participants retrieved more specific memories when they were asked to remember important memories (M = .62, SD = .37) than they were given cue words (M = .47, SD = .30), $F(1,94) = 10.598$, p = .002, MSE = 1.078, η_p^2 = .101. There was also a main effect of group, revealing that low BDI participants produced more specific memories (M = .57, SD = .03) than high BDI participants (M = .50, SD = .35), $F(1,94) = 3.964$, p = .049, MSE= .449, η_p^2 = .040. There was no interaction (p = .551) (see figure 1).

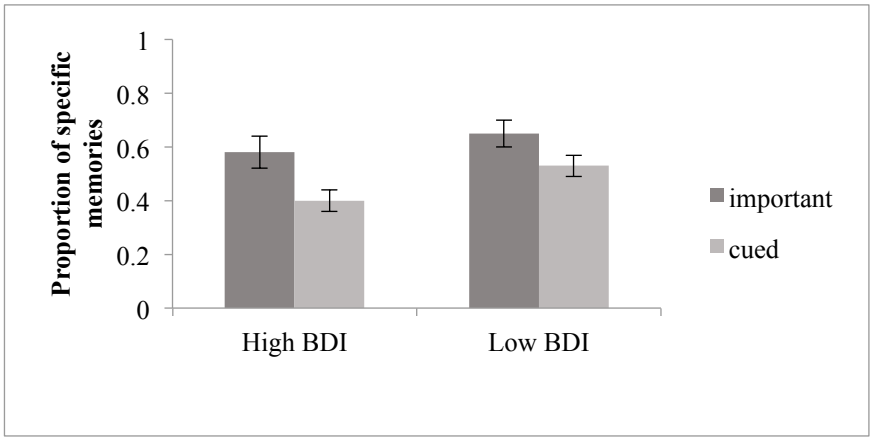

Figure 1 Proportion of specific memories according to cue type for both groups

3.6 Interrelationships among EF, brooding and ABM

To examine the nature of the relationship between EF impairments and brooding and how they are related to memory specificity in depression, a moderated mediation model was tested (see figure 2). We hypothesized that brooding's effect on memory specificity would be through EF impairments and no direct effect on brooding on memory specificity would be observed. Therefore, brooding was placed as the

independent variable and EF impairments as the mediator variable. We also hypothesized that this relationship would be moderated by depressive symptoms: for the low BDI group, brooding would have neither a direct nor an indirect effect on memory specificity. Furthermore, in the low BDI groups, EF impairments would not be related to memory specificity.

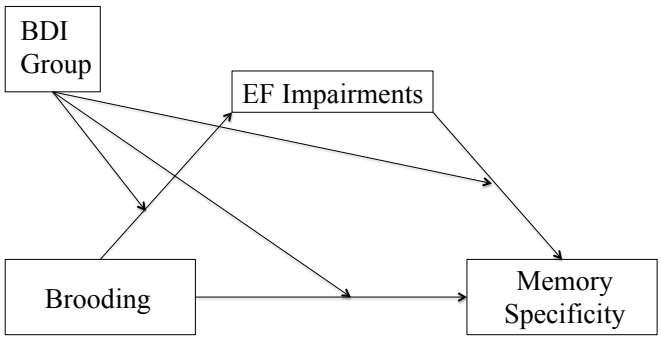

Figure 2 Moderated mediation model of memory specificity BDI group as moderator and EF impairments as mediator.

For the model, scores of the brooding subscale of RRS were used for brooding. Since in the present study, shifting, updating and two inhibition measures were collected, the model was conducted 7 times using the PROCESS macro (Hayes, 2017). For shifting, 4 models, (total number of correct answers, perseverance errors, non perseverance errors, and categories completed); for updating 1 model (proportion of correct for 2-back), and for inhibition 2 models (difference in proportion of correct answers between congruent and congruent trials for Eriksen Flanker task; difference between number of trials required to learn list 3 and list 1 for AB/AC/AD task) were conducted.

The model was significant only for non-perseverance errors and number of correct answers. It was not significant for the other 5 EF measures (all *p*s > .147). Figures 3 and 4 depict the statistical diagram of the model for non-perseverance errors and number of correct answers respectively.

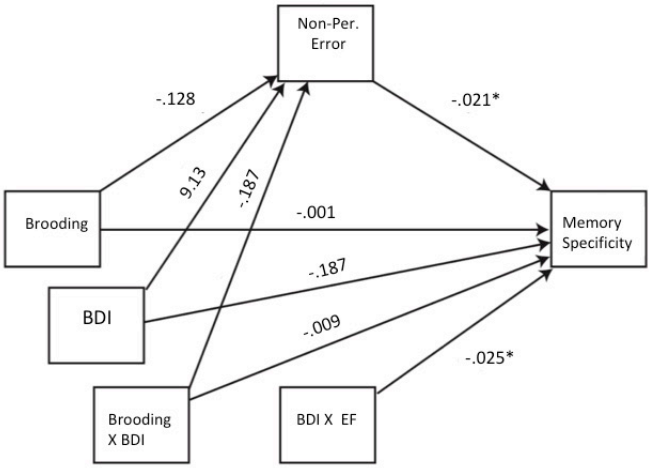

Figure 3 Statistical diagram of the moderated mediation model for non perseverance errors

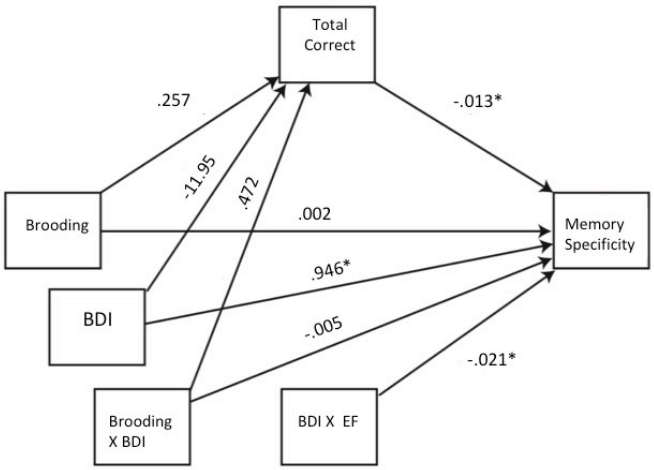

Figure 4 Statistical diagram of the moderated mediation model for total correct answers.

For both non-perseverance error and correct answers, the results of the analyses showed that brooding did not have a direct or an indirect effect mediated by EF impairments on memory specificity. On the other hand, both non-perseverance error and correct answers had direct effects on memory specificity and this effect is moderated by BDI group. Memory specificity of participants in the low BDI groups was not affected by EF impairments. Only for the high BDI group, there was an effect of EF deficits on memory specificity. Results of the analyses can be seen in tables 4 and 5 for non-perseverance errors and total correct answers respectively.

Table 4. Results of Model Analysis for Non-perseverance Errors as Mediator

	Consequent					
	M (Non-Perseverance)			Y (Memory Specificity)		
Antecedent	Coeff.	*SE*	*p*	Coeff.	*SE*	*p*
X (Brooding)	-.128	.627	.154	-.001	.022	.966
M (Non-Per.)	--	--	--	-.021	.007	.006
W (BDI group)	9.130	8.887	.307	-.187	.328	.570
X x W	-.346	-.443	.659	-.009	.027	.729
M x W	--	--	--	.025	.0086	.003
Constant	8.416	5.860	.154	.685	.216	.002
	$R^2 = .063$			$R^2 = .141$		
	$F(3,91) = 2.04$, $p = .114$			$F(5,89) = 2.92$, $p = .018$		

Table 5. Results of Model Analysis for Total Correct Answers as Mediator

	Consequent					
	M (Total Correct)			Y (Memory Specificity)		
Antecedent	Coeff.	*SE*	*p*	Coeff.	*SE*	*p*
X (Brooding)	.257	.645	.691	.002	.022	.939
M (Total Correct)	--	--	--	.013	.006	.019
W (BDI group)	-11.957	9.138	.194	.946	.438	.033
X x W	.472	.804	.558	-.005	.028	.847
M x W	--	--	--	-.021	.007	.005
Constant	45.919	6.026	.001	-.107	.332	.748
	$R^2 = .084$			$R^2 = .133$		
	$F(3,91) = 2.79$, $p = .045$			$F(5,89) = 2.74$, $p = .024$		

In hypothesis 4, we predicted that for only for the word-memories, participants in the high BDI group who were impaired in updating, shifting and resistance to PI subcomponent of inhibition would score higher in brooding and produce less specific memories than participants who are not. Although the models tested above demonstrated a direct relationship between two measures of shifting and memory specificity of word-cued memories for the high BDI group, they could only test the effects of different EF measures one by one. Therefore to explore how different EFs are related to memory specificity in relation with each other, hierarchical multiple regression analyses were conducted for low and high BDI groups separately using the proportion of specific memories in response to cue words and the proportion of specific important memories as the dependent variables.

The aim of the study was to see whether different subcomponents EF affect memory specificity differently in participants with and without depression differently rather than to see whether depression affects these measures or not. Therefore regression analyses for groups were conducted separately rather than using BDI group as a predictor. To account participant characteristics, gender and state anxiety scores from the second session and trait anxiety scores were entered in the first step. The second step contained the brooding style rumination score. In the third and final step, EF measures were entered. For shifting four BCST scores (total number of correct answers, perseverance errors, non-perseverance errors, and categories completed), for updating proportion of correct answers 2-back task and for resistance to PI subcomponent of inhibition one AB/AC/AD task score (difference between the number of trials to learn list 3 and list1) were entered. All assumptions for regression analysis were met. To see whether there was multicollinearity between variables, correlations the between variables were examined showing

multicollinearity between variables. Since the number of correct answers measure of BCST is highly correlated with other BCST measures, it was dropped from the model. Tables 6 and 7 show the first-order correlations between predictor variables and the criterion variable for low BDI and high BDI groups respectively.

Table 8 shows the results of the hierarchical multiple regression analysis with the proportion of specific memories in response to cue words as the dependent variable for the low BDI group. Consistent with our hypothesis, none of the models were significant (all *p*s> .625).

On the other hand, for the high BDI group, although the first two models were not significant (*p*s> .562), the final model explained 44% of the variance for the proportion of specific memories $F(9, 40) = 2.75$, $p < .017$. Result of the regression analysis can be seen in Table 9. Results of the EF measures only partially support our hypothesis since only shifting measures significantly contributed to the models. Number of perseverance errors ($\beta = .662$, $t(31) = 3.20$, $p = .003$); number or non-perseverance errors ($\beta = .1.156$, $t(31) = 4.16$, $p < .001$), and number of categories completed ($\beta = .1.043$, $t(31) = 4.13$, $p < .001$) predicted proportion of specific memories. None of the updating or inhibition measures were significant predictors (all *p*s> .202).

Table 6. Intercorrelations Among Predictor Variables and DVs for low BDI group

	Prop. spec. for cue	Prop. spec. for important	State anxiety 2nd	Trait anxiety	Brooding	Congruent-incongruent	2-back	Bcst total correct	Perseverance errors	Non-per errors	Cat. Complete	L3-L1
Prop. spec. for cue	-											
Prop. spec. for important	-.011	-										
State anxiety 2nd	.009	.202	-									
Trait anxiety	.065	.137	.284*	-								
Brooding	.010	-.061	.228	0.199	-							
Congruent-incongruent	.087	-.192	.117	-.026	.009	-						
2-back	.103	-.201	0.051	.053	.193	.404**	-					
Bcst total correct	.329*	-.012	-.025	.363**	.065	.022	.252	-				
Perseverance errors	-0.062	-.056	.131	.008	-.060	-.122	-.147	-.664**	-			
Non-per errors	-.390**	.056	-.061	-.485**	-.043	.058	-.233	-.843**	.157	-		
Cat. Complete	.254	-.127	-.112	.220	-.012	.128	.237	.839**	-.612**	.668**	-	
L3-L1	.106	-.033	.249	.398**	.306*	-.275	.067	-.015	.145	-.077	-.141	-

Table 7. Intercorrelations Among Predictor Variables and DVs for low BDI group

	Prop. spec. for cue	Prop. spec. for important	State anxiety 2nd	Trait anxiety	Brooding	Congruent-incongruent	2-back	Bcst total correct	Perseverance errors	Non-per errors	Cat. Complete	L3-L1
Prop. spec. for cue	-											
Prop. spec. for important	.130	-										
State anxiety 2nd	-.185	-.013	-									
Trait anxiety	.046	.141	-.002	-								
Brooding	-.113	-.129	.388**	.123	-							
Congruent-incongruent	.130	.211	-.043	-.270	-.135	-						
2-back	-.057	-.034	-.172	.227	.306	.122	-					
Bcst total correct	-.260	-.029	.151	.212	.203	-.335*	.284	-				
Perseverance errors	.134	-.080	.083	-.253	-.128	.119	-.419**	-.124	-			
Non-per errors	.171	.068	-.182	-.066	-.122	.248	-.050	-.861**	-.398**	-		
Cat. Complete	.030	.032	.220	.219	.197	-.291	.099	.824**	-.059	-.731**	-	
L3-L1	-.148	.092	.088	-.087	.068	-.025	-.102	.003	-.121	.059	.139	-

Table 8. Summary of Hierarchical Multiple Regression Analysis of Proportion of Specific Memories in Response to Cue Words for The Low BDI Group

Step	ΔR^2	DF	*F-Change*	*B*	SE	*β*	*p*
1.	.26	3, 43	.384				
Gender				.069	.085	.122	.424
SAI 2nd				-.002	.009	-.033	.840
TAI				.002	.004	.109	.496
2.	.00	1, 42	.001				
Gender				.069	.088	.123	.435
SAI 2nd				-.002	.009	-.034	.840
TAI				.002	.004	.108	.508
Brooding				.001	.026	.006	.972
3.	.13	5, 37	1.197				
Gender				.064	.090	.114	.481
SAI 2nd				.001	.009	.022	.896
TAI				-.004	.005	-.178	.391
Brooding				.001	.027	-.006	.974
2-back				-.041	.282	-.024	.884
Per. error				.003	.016	.036	.861
Nonper. error				-.020	.014	-.383	.168
Cat. completed				.022	.075	.087	.770
L3-L1				.051	.066	.133	.448

Note: SAI 2nd: participants' state anxiety score from the second session; TAI: Trait anxiety score; Brooding=RRS brooding score; n2=proportion of correct answers during 2-back task; Total Correct=Total number of correct answers in BCST; Per. Error: Total number of perseverance errors in BCST; Nonper. Error: Total number of non-perseverance errors in BCST; Cat. Complete : Total number of categories completed in BCST; L3-L1=difference between number of trials required to learn list 3 and list 1 in AB/AC/AD task.

Table 9. Summary of Hierarchical Multiple Regression Analysis of Proportion of Specific Memories in Response to Cue Words for the High BDI Group

Step	ΔR^2	DF	*F-Change*	*B*	SE	*β*	*p*
1.	.77	3, 37	1.025				
Gender				-.129	.099	-.215	.201
SAI 2nd				-.005	.006	-.156	.337
TAI				.001	.004	.031	.853
2.	.00	1, 36	0.02				
Gender				-.131	.102	-.220	.206
SAI 2nd				-.005	.006	-.145	.420
TAI				.001	.004	.037	.831
Brooding				-.003	.021	-.026	.887
3.	.37	5, 31	4.087				
Gender				-.116	.088	-.194	.197
SAI 2nd				-.007	.006	-.206	.210
TAI				.001	.003	.040	.797
Brooding				.000	.019	-.003	.988
2-back				.143	.245	.103	.564
Per. error				.036	.011	.662	.003
Nonper. error				.032	.008	1.156	.000
Cat. completed				.235	.057	1.043	.000
L3-L1				-.054	.042	-.194	.202

Note: SAI 2nd: participants' state anxiety score from the second session; TAI: Trait anxiety score; Brooding=RRS brooding score; n2=proportion of correct answers during 2-back task; Total Correct=Total number of correct answers in BCST; Per. Error: Total number of perseverance errors in BCST; Nonper. Error: Total number of non-perseverance errors in BCST; Cat. Complete : Total number of categories completed in BCST; L3-L1=difference between number of trials required to learn list 3 and list 1 in AB/AC/AD task.

According to hypothesis 4, contrary to the findings for cued memories, for the important memories, impairments in updating, shifting and resistance to PI component of inhibition were not expected to impair the retrieval processes for the high BDI group. In other words, impairment in EF would not predict the proportion

of specific memories retrieved when asked to retrieve important memories. To test this hypothesis, as in Study 1, 2 hierarchical multiple regression analyses were conducted with the proportion of important specific memories as the dependent variable for both groups. Same steps were followed for the predictor entry to the model. As expected, unlike the cued memoires, for important memories, none of the models were significant for both groups (all *p*s> .136) showing that impairments in EF and higher brooding scores do not predict memory specificity of important memories. Results can be found in Tables 10 and 11.

Table 10. Summary of Hierarchical Multiple Regression Analysis of Proportion of Specific Important Memories for the low BDI Group

Step	ΔR^2	DF	*F-Change*	*B*	SE	*β*	*p*
1.	.08	3, 43	1.277				
Gender				-.065	.105	-.090	.543
SAI 2nd				.007	.011	.103	.509
TAI				.006	.004	.215	.171
2.	.04	1, 42	1.459				
Gender				-.091	.107	-.128	.398
SAI 2nd				.011	.011	.155	.338
TAI				.007	.004	.241	.128
Brooding				-.038	.032	-.192	.234
3.	.17	5, 37	1.806				
Gender				-.061	.105	-.085	.569
SAI 2nd				.007	.011	.103	.512
TAI				.014	.005	.492	.013
Brooding				-.026	.032	-.131	.416
2-back				-.369	.332	-.165	.273
Per. error				-.028	.019	-.277	.148
Nonper. error				.012	.017	.186	.463
Cat. completed				-.087	.089	-.267	.335
L3-L1				-.087	.078	-.179	.270

Note: SAI 2nd: participants' state anxiety score from the second session; TAI: Trait anxiety score; Brooding=RRS brooding score; n2=proportion of correct answers during 2-back task; Total Correct=Total number of correct answers in BCST; Per. Error: Total number of perseverance errors in BCST; Nonper. Error: Total number of non-perseverance errors in BCST; Cat. Complete : Total number of categories completed in BCST; L3-L1=difference between number of trials required to learn list 3 and list 1 in AB/AC/AD task.

Table 11. Summary of Hierarchical Multiple Regression Analysis of Proportion of Specific Important Memories for the high BDI Group

Step	ΔR^2	DF	*F-Change*	*B*	SE	*β*	*p*
1.	.09	3, 37	1.266				
Gender				.211	.128	.269	.108
SAI 2nd				-.006	.007	-.122	.445
TAI				.002	.005	.079	.631
2.	.01	1, 36	.247				
Gender				.198	.132	.252	.143
SAI 2nd				-.004	.008	-.086	.628
TAI				.003	.005	.100	.559
Brooding				-.013	.027	-.090	.622
3.	.02	5, 31	.138				
Gender				.188	.145	.239	.206
SAI 2nd				-.004	.009	-.096	.638
TAI				.003	.005	.112	.570
Brooding				-.012	.032	-.083	.698
2-back				-.077	.404	-.042	.851
Per. error				-.001	.019	-.007	.977
Nonper. error				.006	.013	.176	.617
Cat. completed				.033	.094	.112	.726
L3-L1				.012	.069	.032	.863

Note: SAI 2nd: participants' state anxiety score from the second session; TAI: Trait anxiety score; Brooding=RRS brooding score; n2=proportion of correct answers during 2-back task; Total Correct=Total number of correct answers in BCST; Per. Error: Total number of perseverance errors in BCST; Nonper. Error: Total number of non-perseverance errors in BCST; Cat. Complete : Total number of categories completed in BCST; L3-L1=difference between number of trials required to learn list 3 and list 1 in AB/AC/AD task.

CHAPTER 4

DISCUSSION

Present study investigated the interrelations between executive functioning, rumination and memory specificity in depression. We postulated that higher levels of depression would be associated with higher levels of rumination and more deficits in executive functions. We suggested that both high and low BDI participants would produce more specific memories for important memories than for cue words and participants with high BDI would produce less specific memories than participants with low BDI for word-cued memories. Furthermore, we stated that for the word-cued memories, higher levels of depression, deficits in updating, shifting and the resistance to PI subcomponent of inhibition would lead to higher levels of brooding and more OGMs. Supporting our hypotheses, a significant relationship between depression and rumination, executive function deficits was found. Participants with high BDI scores produced higher rumination scores, more deficits in executive functioning and more reduced memory specificity in response to cue words. Furthermore, both low and high BDI participants retrieved more specific memories for important memories and for both word-cued and important memories high BDI participants retrieved less specific memories than low BDI participants. However, brooding was neither related to the EF measures nor to the memory specificity. Furthermore, updating and the resistance to PI scores were found to be not related memory specificity. Only shifting scores predicted memory specificity. In the following sections, I first discussed the group differences in EF and rumination and continued by discussing the interrelations between rumination, EF and memory specificity in depression.

4.1 Executive function deficits

Results of the present study showed that the effects of depression were observed on specific EFs. Although participants with high BDI scores performed equally well with the participants with low BDI scores in tasks with low demands, deficits are evident in shifting (Harvey et al., 2004), updating (Pelosi et al., 2000) and resistance to distractor subcomponent of inhibition (Aker et al., 2016). However, groups did not differ for the resistance to PI subcomponent contradicting the literature (e.g. Fawcett et al., 2015).

As expected, performances of low and high BDI groups for the 1-back task and correct answers in congruent trials of the Eriksen Flanker task were not significantly different from each other showing that they had a normal behavioral performance. However as the complexity of the task increased, the deficits in the updating and abilities of the high BDI participants became evident. These findings support our hypotheses stating that there will be impairing effects of depression on updating and resistance to distractor subcomponent of inhibition abilities supporting the literature (e.g. Aker et al., 2016; Harvey et al., 2004; Harvey et al., 2005; Pelosi et al., 2000).

However, contrary to our hypothesis, groups did not differ from each other in any of the measures for the resistance to PI subcomponent of inhibition, This finding may be due the use of neutral words as the stimuli for the resistance to the PI tasks. It has been demonstrated that that depressed participants show inhibition deficits for the negative words but not for the neutral words among different inhibition tasks (e.g. Gotlib & Cane, 1987; Joorman & Gotlib, 2008). Furthermore, Joorman, et al. (2007) stated that there is limited support in the literature for the impaired inhibition of no longer relevant neutral materials in depression. In the present study, neutral

stimuli was used to be able to make inferences regarding the general executive functioning instead of executive functioning of the emotional stimuli. This might be a possible reason behind this lack of significant group effect.

In line with our hypothesis, high BDI group performed worse than the low BDI group in the BCST and produced fewer correct answers, completed fewer categories and made more non-perseverance errors. These findings were consistent with literature (Snyder 2013; Snyder et al., 2015). Our findings showing the group differences in non perseverance error support the findings showing that individuals with MDD show more sensitivity to negative feedback (Olvet & Hajcak, 2008) leading a decrease in their performance adjustments after incorrect trials.

We failed to replicate the findings showing an increase in perseverance errors as depression levels go higher (e.g. Harvey et al., 2004). However, similar to the present study, some studies (e.g. Degl'Innocenti, Agren, & Baeckman, 1998) also failed to find group differences in perseverance errors but found significant differences in non-perseverance errors. Degl'Innocenti et al. (1998) stated that the lack of difference in perseverance errors was an indication of the depressed participants' ability to monitor their performance as well as the controls. They were able to receive feedback and change their behaviors. However, the difference between two groups for the non-perseverance errors showed that although depressed participants were able to receive feedback and change behavior, they failed to choose the correct response. Degl'Innocenti et al. (1998) suggested that this was because depressed participants had difficulties in using the feedback they received properly. They made errors not because they perseverate but because they cannot use available information properly to reach the correct response. They claimed that this suggestion is in line with Beck's cognitive model of depression (Beck & Haigh, 2014),

proposing that people with MDD have difficulties in evaluating information properly and in changing their negative beliefs. In line with Degl'Innocenti et al. (1998), results of the present study also provide support for Beck's cognitive model of depression (Beck & Haigh, 2014) showing that although participants with high BDI were able were able to receive feedback and change their behaviors (shown by the non-difference in perseverance errors) they failed to choose the correct response (hence the difference between two groups for the non-perseverance errors).

Another reason behind this lack of difference between groups for the perseverance errors could be the nature of this error. Perseverance errors also reflect inhibition deficits (Miyake, Emerson, & Friedman, 2000). When participants classify the card according to the previous rule after the rule changed, this is called a perseverance response. If the participant makes the same mistake after she is told her response is not accurate, it is called a perseverance error. So, a perseverance error involves both shifting to a new response and inhibiting the previous one, in other words inhibition of PI. The lack of deficit in inhibition in our sample may explain why both groups performed equally well in terms of perseverance errors.

Another point to keep in mind when evaluating the findings of the present study is that we used the 64-card version of the BCST. Although this version has been shown as reliable and valid (Fox, Mueller, Gray, Raber & Paper, 2013) there are several studies claiming that it is less valid compared to the 128-card version (Love, Greve, Sherwin & Mathias, 2003) since it is less demanding. Based on their study on participants with brain injury, Love et al. (2003) suggested that in some cases the 64-Card version might underestimate the deficiencies present. They claimed that as the test progresses, the participants would get tired and their motivations would drop making the impairments more evident.

4.2 Rumination

High BDI group had higher total rumination, brooding and reflection scores than the low BDI group. However, our findings were not consistent with previous findings in the literature that showed a relation between brooding stlye rumination and EF measures (e.g. Levens et al., 2009; Watkins & Brown, 2002).

The findings regarding the relationship between brooding and EF is mixed in the literature. Findings showed that factors like the valence of the stimuli used for the EF tasks and the mood of the participant can affect the relationship between these constructs. For example, although there are studies showing updating and brooding is related (Bernstein, Heeren, & McNally, 2017), Quinn and Joorman (2015) showed updating was related to brooding only under stress. Moreover, Joorman (2006) showed that rumination is related to inhibition of only negative information. This finding can explain the lack of relation between rumination and inhibition of the neutral materials in the present study. Furthermore, some studies could not find a relationship between brooding and prepotent response inhibition even for emotional material (Bernstein et al., 2017).

Lo and Liu (2017) examined the relation between rumination and shifting and inhibition with a mixed antisaccade task using emotional stimuli. In line with our study, results showed no relation between rumination and inhibition and shifting for neutral stimuli. The only relation Lo and Liu found was between shifting and rumination for the negative stimuli. This findings support the idea that the null findings in our study are due the use of neutral stimuli. On the other hand, De Lissnyder, Derakshan, De Raedt and Koster (2011) explored the relationship between rumination and inhibition and shifting using non-emotional material using the mixed anti saccade task in a non-clinical sample. Their results showed that

rumination is related to impairments in inhibition for neutral materials. Together with our results, these findings leave the question whether the relationship between rumination and EF is affected by the nature of stimuli to be explored.

Finally, participants in the present study showed no impairments in resistance to PI subcomponent of inhibition. Although they have higher rumination levels, the intact resistance to PI abilities of the high BDI group prevents their rumination levels to impair memory processes since they can inhibit ruminative thoughts and disengage from them. Zetche et al. (2012) showed rumination is caused by the difficulties in inhibiting the irrelevant negative thoughts in working memory, a difficulty not experienced by our sample. This might be another reason behind the lack of relation between rumination and memory specificity in the high BDI group.

4.3 Effects of cue type

Present study examined the effects of cue type on OGM and whether these effects were related to executive functioning and rumination in depression with the aim of examining the retrieval processes underlying OGMs. In line with hypothesis 3, both groups produced more specific memories in response to important memories than cue words and participants in the high BDI group produced less specific memories than participants in the low BDI group for both cue types..

Williams et al. (2007) based the CaRFAX model on SMS (Conway & Pleydell-Pearce, 2000) stating that when presented with cue words, individuals enter the ABM hierarchy at the general event knowledge level and then the activation extends to lower levels until a specific memory is activated. This process is called generative retrieval. Williams et al. (2007) suggested that when individuals with depression are presented with cue words, they initiate the search process from the top

level as the healthy individuals but they fail to continue their search due to rumination, the impairments in EF or functional avoidance. If that were the case, when individuals with depression were presented with cues that will initiate a directive retrieval process rather than a generative one, they would not experience problems with memory specificity. Supporting this line of thought, our results showed that if participants with depression were led to retrieve memories through directive recall instead of generative recall using important memories as cues, they tend to recall memories as specific as the non-depressed participants. Moreover, impairments in the executive functioning did not affect the retrieval processes of important memories as they did the retrieval processes of cued memories in neither high nor low BDI groups. These results are in line with both Williams et al.'s (2007) CaRFAX model and SMS (Conway & Pleydell-Pearce, 2000).

4.4 Interrelations between EF, rumination and ABM in depression

Another aim of the present study was to explore the relations between EF, rumination and memory specificity in depression. It was expected that ford the word-cued memories only for the high BDI group, participants who are impaired in updating, shifting and resistance to PI would be higher on brooding and produce more OGMs than participants who are not impaired in these EF components. Results partially supported our hypotheses. In line with the literature (Williams et al., 2007) the relations between EF and memory specificity is evident only for the high BDI group. However, only a significant effect of shifting was found suggesting that shifting is more involved in memory retrieval than other EF subcomponents. Furthermore, in support of Hypothesis 2, EF deficits were not related to memory specificity of important memories in neither group.

Miyake and Friedman (2012) conceptualize shifting as the ability to transition between different representations, a process that involves both inhibiting the previous representation and selecting and keeping active the correct next representation. Our findings showed that participants with high BDI were able to inhibit the no longer irrelevant information but they fail to choose the correct response. The relationship between shifting measures and memory specificity suggest that participants in the high BDI group may experience problems activating the expected response, in this case specific memories.

Although there was a relationship between shifting and memory specificity, updating and inhibition were not related to memory specificity contradicting the studies suggesting a general EF impairment is related to OGMs in depression (e.g. Harvey et al., 2004; Piolino et al., 2010). However, most of the studies in the literature investigating the relationship between EF and memory specificity measured only one aspect of EF like working memory (Birch & Davidson, 2007), verbal fluency (Sumner et al., 2012), and shifting (Connoly et al., 2014) and used their findings to reach conclusions about all EFs. Furthermore, Haddad et al. (2014) explored the relationship between EF and memory specificity in recovered depressed women. Similar to our findings they did not find a relation between memory specificity and random number generations task, a task that taps both updating and inhibition components of EF (Miyake et al., 2000). Together with these findings, the present study highlights the importance of measuring different EF to understand the underlying mechanisms behind memory specificity by showing that the nature of the relationship between EF and memory specificity changed according to the EF measured.

We also contradicted previous findings (e.g. Hallford & Mellor, 2017; Raes et al., 2006) by failing to find a relation between rumination and memory specificity. A possible explanation for this lack of relation was provided by the findings of Smets, Griffith, Wessel, Walschaerts, and Raes (2013). Smets et al. (2013) suggested that for rumination to have a negative effect on memory specificity it should be in an activated state. In participants diagnosed with MDD it is already in an activated state so the effects are easily observed. However for the participants who are not diagnosed with MDD, it should be activated via rumination induction procedures to show its effects on cognitive processes (Nolen-Hoeksama et al., 2008; Smets et al., 2013). Moreover, in line with these findings, Wessel et al., (2014) found that the relation between rumination and memory specificity was only present when self-discrepant cues were used not when positive and negative cues were used. Wessel et al., (2014) stated that using self-discrepant cues lead to activation of the ruminative processes and leading reduced specificity of retrieved ABMs.

Furthermore, our study is not the first study that fails to find the relationship between rumination and memory specificity in analog samples. In a recent study Ros, Latorre, Serrano and Ricarte (2017) examined the age effects on the three components of the CaR-FA-X model. For both older and younger adults, rumination was found to be unrelated to memory specificity. Similarly, Takano, Mori, Nishiguichi, Moriya and Raes (2017) also failed to find a significant relationship between OGM and rumination.

When put together, our results suggest that a modification is needed in the CaR-FA-X model. First of all, our findings showed that only shifting subcomponent of EF was related to memory specificity in the high BDI group. Therefore, the Car-FA-X model needs to be upgraded to include differentiating effects of different

subcomponents of EF and explore these differences. Furthermore, The lack of relation between rumination and memory specificity contradicts the CaR-FA-X model, which states that rumination is one of the main mechanisms underlying OGMs. Our results suggest that in analog samples, the relationship between rumination and memory specificity is not as strong as the relationship in clinical samples. As described above, rumination is not always active in non-clinical samples. Rather it should be activated via rumination induction manipulation to show its effects on different cognitive processes. Together with the results discussed above, our findings suggest that state rumination but not trait rumination is related to OGM. In the CaR-FA-X model (Williams et al., 2007), no distinction between state and trait rumination was made. An update in the model regarding this issue is needed to explain the effect of rumination on memory specificity in analog samples.

Chapter 5

CONCLUSIONS AND LIMITATIONS

5.1 Conclusions

Williams et al. (2007) suggested that capture and rumination, functional avoidance, and impaired executive functions are the three mechanisms affecting the formation of OGM in depression. The presence of one or more of the three mechanisms results in OGM. CaR-FA-X model assumes that the three mechanisms can both act independently from or in interaction with each other; however, the relationships among the three were not well examined in previous studies (e.g. Sumner, 2014). Present study examines the interrelations between rumination, executive functions, and memory specificity in depression using the CaR-FA-X model (Williams et al., 2007) as a framework.

In line with the predictions of the CaR-FA-X model, our results showed that high BDI participants scored higher on rumination and demonstrated more EF deficits and retrieved less specific memories than low BDI participants. Moreover, our results also provided support for the relationship between OGM and Self-Memory System (Conway, 2005) proposed by the Car-FA-X model in that when the participants with depression were lead to use direct retrieval instead of generative retrieval during remembering, the memories they retrieved were not different from the memories of participants with no depression. When high BDI participants were asked to retrieve important memories to initiate direct retrieval, they performed equally well with low BDI participants

However, when the relationships between rumination, EF deficits and memory specificity were examined, our results showed rumination was not related to

memory specificity and it was not related to EF deficits in the high BDI group contradicting the literature and the CaR-FA-X model (Williams et al., 2007). These findings suggest that a modification regarding the role of rumination is needed in the CaR-FA-X model.

Furthermore, among the EF deficits, only shifting predicted memory specificity in the high BDI group suggesting that not all EFs are equally important for memory specificity and shifting is more fundamental for memory retrieval processes than the other functions. However, most of the studies examining the effects of EF impairments on memory specificity ignored the distinctions between the subcomponents of EF, resulting in conflicting results. Our results clearly demonstrated the importance of exploring the effects of different EFs to understand the relationship between retrieval processes leading to OGMs and executive functioning.

5.2 Limitations and future directions

Some potential limitations ıf the present study may be mentioned. First of all, all participants were between the ages of 18-20. Findings show that the nature of the relationship among EF, rumination and memory specificity in depression may change with age (Ros et al., 2017). In old adults, EF impairments lead to OGM only for low levels of rumination whereas in young adults EF impairments lead to OGM for high levels of rumination. Therefore the use of only young adults in the present study limits the generalizability of the findings. Future studies comparing different age groups are needed.

The gender difference in depression is a well-established finding in literature (e.g. Picinelli & Wilkinson, 2000). However, similar to the most of the studies

examining OGMs in depression (e.g. Dagleish et al., 2007; Raes et al., 2006; Raes, Hermans, & Williams, 2007) gender distribution is uneven in the present study as in there were more female participants than male participants. Studies (e.g. Young, Bellgowan, Bodurka, & Drevets, 2013) showed that females are more successful in retrieving specific memories than men. Moreover, Ros et al. (2017) showed that the underlying mechanisms behind the OGM in depression might be different for men and women. Therefore future studies should be conducted with equal number of female and male participants.

Another possible limitation of the study was the use of 64-card version of the BCST instead of 128-card version. Love et al. (2003) suggested that more shifting impairment to be more evident the 128-card version of the task is needed. They suggested that as the task proceeds, participants become more tired, making them more likely to show the true extend of the impairments in shifting. Further studies are needed to compare the 64 and 128-card versions of the test on participants with MDD to reach clear conclusion about the validity of the 64 card version.

Furthermore, Nyhus and Barcelo (2009) stated that non-perseverance errors reflect two different kinds of errors. The first type, efficient errors, was defined as the errors made during the trial and error phase of finding the new correct answer. Distraction errors, on the other hand, are defined as the errors made after the correct answer was found because the participant was distracted. Present study did not use this distinction. Further studies using these two different types of error are needed to see which mechanism is broken in depressed participants.

Present study failed to find group differences in resistance to PI subcomponent of inhibition. Several studies (Gotlib & Cane, 1987; Joormann & Gotlib, 2008) suggested that participant with depression show impairment in resistance to PI

subcomponent of inhibition only for emotional stimuli. In the present study only neutral words were used as stimuli. Future studies should examine the effect of depression on resistance to PI subcomponent of inhibition comparing emotional and neutral stimuli.

Our results regarding rumination were not consistent with the literature. There are two possible reasons behind these contradicting results. First of all, studies stated that for rumination to have impairing effects on cognition, it should be in an activated state (Nolen-Hoeksama, 2000). It is suggested that for rumination to be active in analog samples, it should be purposely activated using rumination inductions. Although our study used an analog sample no rumination induction procedures were used and rumination was only measured using RRS. Future studies comparing the effects of state (activated by rumination induction) and trait (measured by RRS) rumination on memory specificity in analog samples are needed to reach a conclusion.

The second reason might be the use of neutral stimuli in EF tasks in the present study. Previous findings (e.g. Lo & Liu, 2017) suggested that rumination and impairments in EF functions are only evident when emotional stimuli are used for the EF tasks. Since using emotional stimuli would answer the question whether depressed individuals respond differently to emotional stimuli and how this affects memory specificity rather than whether EF deficits are related to depression and memory specificity, present study choose to use neutral stimuli for EF tasks. Future studies need to explore the relation between rumination and EF using emotional versus non-emotional material.

APPENDIX A

AUTOBIOGRAPHICAL MEMORY TEST INSTRUCTIONS

In this study we ask you to remember memories involving certain emoitons. We ask you to explain the memories you remember clearly, with a beginning and an end, directly related to you belonging to events that happened at a certrain time and place as detailed as possible. The memories should be older than one year.

Please describe a memory older than one year triggered by the cue word presented as detailed as possible. The memory must belong to an event you were involved or witnessed. The event must have happened at a certain time and place.

APPENDIX B

SHORT VERSION OF RUMINATIVE RESPONSES SCALE

People think and do many different things when they feel depressed. Please read each of the items below and indicate whether you almost never, sometimes, often, or almost always think or do each one when you feel down, sad, or depressed. Please indicate what you generally do, not what you think you should do.

(İnsanlar kötü bir deneyim yaşadıklarında bir sürü farklı şey yapar ya da düşünürler. Lütfen aşağıdaki cümleleri okuyup, son iki hafta içinde, belirtilenleri ne kadar sıklıkta yaptığınızı işaretleyin. Lütfen, ne yapmanız gerektiğini değil, gerçekte ne yaptığınızı belirtin.)

1	2	3	4
Never *(Hiçbir Zaman)*	Sometimes *(Bazen)*	Often *(Çoğunlukla)*	Almost Always *(Her Zaman)*

1. ___think "What am I doing to deserve this?"
   (Bunu hak etmek için ne yaptım" diye ne sıklıkla düşünüyorsun?)
2. ___ analyze recent events to try to understand why you are depressed
   (Son zamanlarda yaşadığın olayları analiz edip "Kendimi niye böyle üzgün hissediyorum" diye "ne sıklıkla düşünüyorsun?)
3. ___ think "Why do I always react this way?"
   ("Niye bu şekilde bir tepki gösteriyorum?" diye ne sıklıkla düşünüyorsun?)
4. ___ go away by yourself and think about why you feel this way
   (Bir köşeye çekilip "neden bu şekilde hissediyorum" diye ne sıklıkla düşünüyorsun?)
5. ___ write down what you are thinking about and analyze it
   (Ne sıklıkla, düşüncelerini yazıp, çözümlemeye ve anlamaya çalışıyorsun?)
6. ___ think about a recent situation, wishing it had gone better
   (Son zamanlarda yaşadığın olaylar hakkında "Keşke daha iyi sonuçlansaydı" ne sıklıkla düşünüyorsun?)
7. ___ think "Why do I have problems other people don't have?"
   (Niye benim problemlerim var da, diğer insanların yok" diye ne sıklıkla düşünüyorsun?)
8. ___ think "Why can't I handle things better?"
   ("Neden olayları daha iyi idare edemiyorum" diye ne sıklıkla düşünüyorsun?)

9. ___ analyze your personality to try to understand why you are depressed
   (Kişilik özelliklerini analiz edip "Kendimi niye böyle üzgün hissediyorum" ne sıklıkla düşünüyorsun?)
10. ___ go someplace alone to think about your feelings
    (Ne sıklıkla tek başına bir yere gidip duygularını anlamaya çalışıyorsun?)

APPENDIX C

STATE TRAIT ANXIETY INVENTORY – STATE FORM

INSTRUCTIONS: Some of the expressions people use to describe their emotions are presented below. Please read each expression and mark the rating on the right that matches how you feel at the moment. There are no right or wrong answers. Please do rate **immediately** without dwelling on the expressions
(YÖNERGE:Aşağıda kişilerin kendilerine ait duygularını anlatmada kullandıkları bir takım ifadeler verilmiştir. Her ifadeyi okuyun, sonra da o anda nasıl hissettiğinizi ifadelerin şağ tarafındaki parantezlerden uygun olanını işaretlemek suretiyle belirtin. Doğru ya da yanlış cevap yoktur. Herhangi bir ifadenin üzerinde fazla zaman sarfetmeksizin ***anında*** *nasıl hissettiğinizi gösteren cevabı işaretleyin.)*

		NEVER *(HİÇ)*	A LITTLE *(BİRAZ)*	VERY *(ÇOK)*	COMPLETELY *(TAMAMİYLE)*
1.	I feel calm *(Şu anda sakinim)*	(1)	(2)	(3)	(4)
2.	I feel safe *(Kendimi emniyette hissediyorum)*	(1)	(2)	(3)	(4)
3	I am tense *(Su anda sinirlerim gergin)*	(1)	(2)	(3)	(4)
4	I am regretful *(Pişmanlık duygusu içindeyim)*	(1)	(2)	(3)	(4)
5.	I feel at ease *(Şu anda huzur içindeyim)*	(1)	(2)	(3)	(4)
6	I feel upset *(Şu anda hiç keyfim yok)*	(1)	(2)	(3)	(4)
7	I am presently worrying about possible misfortunes *(Başıma geleceklerden endişe ediyorum)*	(1)	(2)	(3)	(4)
8.	I feel rested (*Kendimi dinlenmiş hissediyorum)*	(1)	(2)	(3)	(4)
9	I feel anxious *(Şu anda kaygılıyım)*	(1)	(2)	(3)	(4)
10.	I feel comfortable *(Kendimi rahat hissediyorum)*	(1)	(2)	(3)	(4)
11.	I feel self-confident *(Kendime güvenim var)*	(1)	(2)	(3)	(4)
12	I feel nervous *(Şu anda asabım bozuk)*	(1)	(2)	(3)	(4)
13	I am jittery *(Çok sinirliyim)*	(1)	(2)	(3)	(4)
14	I feel high strung *(Sinirlerimin çok gergin olduğunu hissediyorum)*	(1)	(2)	(3)	(4)
15.	I am relaxed *(Kendimi rahatlamış hissediyorum)*	(1)	(2)	(3)	(4)
16.	I feel content *(Şu anda halimden memnunum)*	(1)	(2)	(3)	(4)

17	I am worried *(Şu anda endişeliyim)*	(1)	(2)	(3)	(4)
18	I feel over-exited and rastled *(Heyecandan kendimi şaşkına dönmüş hissediyorum)*	(1)	(2)	(3)	(4)
19.	I feel joyful *(Şu anda sevinçliyim)*	(1)	(2)	(3)	(4)
20.	I feel pleasant *(Şu anda keyfim yerinde)*	(1)	(2)	(3)	(4)

APPENDIX D

STATE TRAIT ANXIETY INVENTORY – TRAIT FORM

INSTRUCTIONS: Some of the expressions people use to describe their emotions are presented below. Please read each expression and mark the rating on the right that matches how you usually feel. There are no right or wrong answers. Please do rate **immediately** without dwelling on the expressions
(YÖNERGE:Aşağıda kişilerin kendilerine ait duygularını anlatmada kullandıkları bir takım ifadeler verilmiştir. Her ifadeyi okuyun, sonra da genelde nasıl hissettiğinizi ifadelerin sağ tarafındaki parantezlerden uygun olanını işaretlemek suretiyle belirtin. Doğru ya da yanlış cevap yoktur. Herhangi bir ifadenin üzerinde fazla zaman sarfetmeksizin ***anında*** *nasıl hissettiğinizi gösteren cevabı işaretleyin.)*

		Almost Never *(Hemen hemen*	Sometimes *(Bazen)*	Often *(Çok zaman)*	Almost Always *(Hemen her*
21.	I feel pleasant *(Genellikle keyfim yerindedir)*	(1)	(2)	(3)	(4)
22	I get tired easily *(Genellikle çabuk yorulurum)*	(1)	(2)	(3)	(4)
23	I cry easily *(Genellikle kolay ağlarım)*	(1)	(2)	(3)	(4)
24	I wish I could be happy as others seem to be *(Başkaları kadar mutlu olmak isterim)*	(1)	(2)	(3)	(4)
25	I miss opportunities because I cannot make quick decisions *(Çabuk karar veremediğim için fırsatları kaçırırım)*	(1)	(2)	(3)	(4)
26.	I feel rested *(Kendimi dinlenmiş hissediyorum)*	(1)	(2)	(3)	(4)
27.	I am calm, cool and collected *(Genellikle sakin, kendine hakim ve soğukkanlıyım)*	(1)	(2)	(3)	(4)
28	I feel that difficulties are piling up so that I cannot overcome them *(Güçlüklerin yenemeyeceğim kadar biriktiğini hissederim)*	(1)	(2)	(3)	(4)
29	I worry too much over something that really doesn' matter *(Önemsiz şeyler hakkında endişelenirim)*	(1)	(2)	(3)	(4)
30.	I am happy *(Genellikle mutluyum)*	(1)	(2)	(3)	(4)
31	I take everything seriously and worry about them *(Her şeyi ciddiye alır ve endişelenirim)*	(1)	(2)	(3)	(4)
32	I lack self-confidence *(Genellikle kendime güvenim yoktur)*	(1)	(2)	(3)	(4)
33.	I feel secure *(Genellikle kendimi emniyette hissederim)*	(1)	(2)	(3)	(4)
34	I avoid stressful and difficult situations *(Sıkıntılı ve güç durumlarla karşılaşmaktan kaçınırım)*	(1)	(2)	(3)	(4)
35	I feel sad *(Genellikle kendimi hüzünlü hissederim)*	(1)	(2)	(3)	(4)
36.	I am content *(Genellikle hayatımdan memnunum)*	(1)	(2)	(3)	(4)

37	Some unimportant thoughts run through my mind and bothers me *(Olur olmaz düşünceler beni rahatsız eder)*	(1)	(2)	(3)	(4)
38	I take disappointments so keenly that I can't put them out of my mind *(Hayal kırıklıklarını öylesine ciddiye alırım ki hiç unutamam)*	(1)	(2)	(3)	(4)
39.	I am steady person *(Aklı başında ve kararlı bir insanım)*	(1)	(2)	(3)	(4)
40	I get in a state of tension and turmoil as I think over my recent concerns and interests *(Son zamanlarda kafama takılan konular beni tedirgin ediyor)*	(1)	(2)	(3)	(4)

APPENDIX E

BECK DEPRESSION INVENTORY - II

Please read the sentences below and mark the one that matches your mood fort he last two weeks.
(Lütfen aşağıdaki cümleleri okuyup, son iki hafta içinde ruh halinizi düşünerek sizin için en uygun olan şıkkı işaretleyiniz.)

For the last two weeks:
(Son iki hafta içinde)

1. **Sadness**
   (Üzüntü)

0 I do not feel sad.
(Kendimi üzüntülü hissetmiyorum.)
1 I feel sad
(Kendimi çoğu zaman üzüntülü hissediyorum.)
2 I feel sad all the time
(Her zaman üzüntülüyüm.)
3 I am so sad and unhappy that I can't stand it
(Öylesine üzüntülü ve mutsuzum ki dayanamıyorum)

2. **Pessimism**
   (Karamsarlık)

0 I am not particularly discouraged about the future.
(Geleceğim hakkında karamsar değilim.)
1 I feel discouraged about the future
(Eskisine kıyasla geleceğim hakkında daha karamsarım(
2 I feel I have nothing to look forward to.
(Benimle ilgili şeylerin iyiye gitmesini beklemiyorum.(
3 I feel the future is hopeless and that things cannot improve.
(Geleceğim hakkında umutsuzum ve her şeyin daha da kötüye gideceğini düşünüyorum).

3. **Past failure**
   (Geçmiş Başarısızlıklar)

0 I do not feel like a failure.
(Kendimi başarısız bir insan olarak görmüyorum.)
1 I feel I have failed more than the average person.
(Beklediğimden daha fazla başarısız oldum.)
2 As I look back on my life, all I can see is a lot of failures.
(Geçmişe baktığımda, çok fazla başarısızlık görüyorum.)
3 I feel I am a complete failure as a person.
(Kendimi tamamen başarısız bir insan olarak görüyorum.)

4. Loss of pleasure
(Zevk alamama)
0 I get as much satisfaction out of things as I used to.
(Her şeyden eskisi kadar zevk alabiliyorum.)
1 I don't enjoy things the way I used to.
(Her şeyden eskisi kadar zevk alamıyorum.)
2 I don't get real satisfaction out of anything anymore.
(Eskiden zevk aldığım şeylerden simdi çok az zevk alıyorum.)
3 I am dissatisfied or bored with everything
(Eskiden zevk aldığım şeylerden şimdi hiç zevk alamıyorum.)

5. Guilty feelings
(Suçluluk Duygusu)
0 I don't feel particularly guilty
(Kendimi özellikle suçlu hissetmiyorum.)
1 I feel guilty a good part of the time about the things I have or I should have done.
(Yaptığım veya yapmış olmam gereken bir çok şeyde kendimi suçlu hissediyorum.)
2 I feel quite guilty most of the time
(Çoğu zaman kendimi oldukça suçlu hissediyorum.)
3 I feel guilty all of the time.
(Kendimi sürekli suçlu hissediyorum.)

6. Punishment feelings
(Cezalandırılma Duygusu)
0 I don't feel I am being punished.
(Cezalandırılıyormuşum gibi gelmiyor.)
1 I feel I may be punished.
(Cezalandırılabileceğimi düşünüyorum.)
2 I expect to be punished.
(Cezalandırılmayı bekliyorum.)
3 I feel I am being punished.
(Cezalandırıldığımı düşünüyorum.)

7. Slef-dislike
(Kendini sevmeme)
0 I don't feel disappointed in myself.
(Kendimle ilgili hislerim değişmedi, her zamanki gibi hissediyorum.)
1 I am disappointed in myself.
(Kendime olan güvenimi kaybettim.)
2 I am disgusted with myself.
(Kendimle ilgili hayal kırıklığına uğradım.)
3 I hate myself
(Kendimi sevmiyorum.)

8. Self-ciritcalness
(Özeleştiri)
0 I don't feel I am any worse than anybody else.
(Eskiye kıyasla kendimi daha fazla eleştiriyor veya suçluyor değilim.)
1 I am critical of myself for my weaknesses or mistakes
(Eskiye kıyasla kendimi daha çok eleştiriyorum.)
2 I blame myself all the time for my faults.
(Bütün kusurlarım için kendimi eleştiriyorum.)
3 I blame myself for everything bad that happens.
(Kötü olan her şey için kendimi suçluyorum.)

9. Suicidial thoughts or wishes
(İntihar düşüncesi veya isteği)
0 I don't have any thoughts of killing myself.
(Kendimi öldürmek gibi bir düşüncem yok.)
1 I have thoughts of killing myself, but I would not carry them out.
(Kendimi öldürmeyi düşünüyorum fakat böyle bir şey yapmam.)
2 I would like to kill myself.
(Kendimi öldürmek istiyorum.)
3 I would kill myself if I had the chance.
(Fırsatını bulsam kendimi öldürürüm.)

10. Crying
(Ağlama)
0 I don't cry any more than usual.
(Eskiye kıyasla daha fazla ağlamıyorum.)
1 I cry more now than I used to.
(Eskiye kıyasla daha fazla ağlıyorum.)
2 I cry all the time now.
(En ufak şey için ağlıyorum.)
3 I used to be able to cry, but now I can't cry even though I want to.
(Ağlamak istiyorum ama ağlayamıyorum.)

11. Agitation
(Tedirginlik
0 I am no more irritated by things than I ever was.
(Eskiye kıyasla daha huzursuz ya da gergin değilim.
1 I am slightly more irritated now than usual.
(Eskiye kıyasla daha huzursuz ya da gergin hissediyorum.)
2 I am quite annoyed or irritated a good deal of the time.
(Öylesine huzursuz ya da tedirginim ki yerimde duramıyorum.)
3 I feel irritated all the time
(Öylesine huzursuz ya da tedirginim ki, sürekli hareket edip bir şeyler yapma ihtiyacı hissediyorum.)

12. Loss of interest

(İlgi kaybı)

0 I have not lost interest in other people.

(Başka insanlara ve aktivitelere karşı ilgimi kaybetmedim.)

1 I am less interested in other people than I used to be.

(Başka insanlara ve aktivitelere karşı eskisinden daha az ilgiliyim.)

2 I have lost most of my interest in other people.

(Başka insanlara ve aktivitelere karşı ilgimi büyük ölçüde kaybettim.)

3 I have lost all of my interest in other people

(Herhangi birşeye karşı ilgi duymakta bile çok zorlanıyorum.)

13. Indecisiveness

(Kararsızlık)

0 I make decisions about as well as I ever could.

(Eskiden olduğu kadar kolay karar verebiliyorum.)

1 I put off making decisions more than I used to

(Eskiden olduğu kadar kolay karar veremiyorum.)

2 I have greater difficulty in making decisions more than I used to.

(Karar verme konusunda eskisinden çok daha fazla zorlanıyorum.)

3 I can't make decisions at all anymore.

(Herhangi bir şeye karar vermekte bile çok zorlanıyorum.)

14. Worthlessness

(Değersiz hissetme)

0 I don't feel worthless

(Kendimi değersiz hissetmiyorum.)

1 I don't feel as valuabel and useful as before

(Eskiden olduğu kadar değerli ve işe yarar olduğumu düşünmüyorum.)

2 I think I am worthless compared to others.

(Diğer insanlara göre daha değersiz olduğumu düşünüyorum.)

3 I. feel completely worthless

(Kendimi tamamen değersiz hissediyorum.)

15. Loss of energy

(Enerji Kaybı)

0 I am energetic

(Eskisi kadar enerjim var.)

1 I am not as energetic as I used to be.

(Eskiye kıyasla daha az enerjim var.)

2 I don't have much energy to do things.

(Çok bir şey yapacak enerjim yok.)

3 I have no energy at all.

(Herhangi bir şey yapacak enerjim yok.)

16. Changes in sleep pattern

(Uyku düzeninde değişiklik)

0 My sleep pattern did not change

(Uyku düzenimde herhangi bir değişiklik yok.)

1a. I sleep a little more than I used to be

(Eskiye kıyasla biraz daha fazla uyuyorum.)

1b. I sleep a little less than I used to.
(Eskiye kıyasla biraz daha az uyuyorum.)
2a. I sleep a lot more than I used to.
(Eskiye kıyasla cok daha fazla uyuyorum.)
2b. I sleep a lot less than I used to.
(Eskiye kıyasla cok daha az uyuyorum.)
3a. I spend my day sleeping.
(Günün çoğunu uyuyarak geçiriyorum.)
3b. I wake 1-2 hours earlier than usualy and cannot go back to sleep again.
(Her zamankinden 1-2 saat erken uyanıyorum ve tekrar uykuya dalamıyorum.)

17. Irritability
(Sinirlilik)
0 I am not irritated.
(Her zamankinden daha sinirli değilim.)
1 I am more irritated than usual.
(Her zamankinden daha sinirliyim.)
2 I am a lot more irritated than usual.
(Her zamankinden çok daha fazla sinirliyim.)
3 I am irritated all the time.
(Sürekli sinirliyim.)

18. Changes in appetite
(İştah değişikliği)
0 My appetite did not change.
(İştahımda herhangi bir değişiklik yok.)
1a. I have a little less appetite than before.
(Eskiye kıyasla biraz daha az iştahlıyım.)
1b. I have a little more appetite than before.
(Eskiye kıyasla biraz daha fazla iştahlıyım.)
2a. I have a lot less appetite than before.
(Eskiye kıyasla cok daha az iştahlıyım.)
2b. I have a lot more appetite than before.
(Eskiye kıyasla çok daha fazla iştahlıyım.)
3a. I have no appetite at all.
(Hiç iştahım kalmadı.)
3b. I eat all the time.
(Sürekli yemek yemek yiyorum.)

19. Concentration difficulty
(Konsantrasyon zorluğu)
0 I can focus as usual.
(Her zamanki gibi iyi konsantre olabiliyorum.)
1 I can't focus as usual.
(Her zamanki gibi iyi konsantre olamıyorum.)
2 It is very difficult for me to focus for a long time.
(Uzun süre dikkatimi bir şeyde toplamam cok zor oluyor.)
3 I can't focus at all.
(Hiç bir şeye konsantre olamıyorum.)

20. Tiredness and fatigue

(Yorgunluk veya bitkinlik)

0 I am not tired or exhausted more than usual.

(Her zamankinden daha yorgun veya bitkin değilim.)

1 I get tired and exhausted easier than usual.

(Her zamankinden daha kolay yoruluyorum veya bitkin düşüyorum.)

2 I am very tired and exhausted to do most of the things I always do.

(Her zaman yaptığım bir çok şeyi yapmak için fazlasıyla yorgun ya da bitkinim.)

3 I am too tired and exhausted to do any of the things I always do.

(Her zaman yaptığım şeylerin hemen hiçbirini yapamayacak kadar çok yorgun ya da bitkinim.)

21. Loss of interest in sex

(Cinsel ilgi kaybı)

0 I did not notice any recent chanhe in my interests in sex.

(Son zamanlarda sekse olan ilgimde bir değişiklik fark etmedim.)

1 I am less interested in sex than I used to be.

(Sekse her zamankinden daha az ilgim var.)

2 I am a lot less interested in sex than I used to be.

(Sekse her zamankinden çok daha az ilgim var.)

3 I have no interest in sex at all.

(Sekse olan ilgimi tamamiyle kaybettim.)

APPENDIX F

DEMOGRAPHICS FORM

1. Gender *(Cinsiyetiniz):* Male *(Erkek)* Female *(Kadın)*

2. Department *(Bölümünüz):* _____

3. Birth Date in day, month, year: _____

(*Doğum Tarihiniz, gün, ay, yıl olarak)*

4. GPA _____

(Genel not ortalamanız)

5. Your score and area in University Entrance Exam: _____

(Üniversiteye giriş puanınız ve türü nedir?)

6. Your mother's education level:

(Annenizin en son bitirdiği okul:)

Elementary School *(İlkokul)* Middleschool *(Ortaokul)* Highschool *(Lise)* Undergraduate *(Üniversite)* Graduate *(Lisansüstü)*

7. Mother's occupation: _____

(Annenizin mesleği)

8. Your father's education level:

(Babanızın en son bitirdiği okul:)

Elementary School *(İlkokul)* Middleschool *(Ortaokul)* Highschool *(Lise)* Undergraduate *(Üniversite)* Graduate *(Lisansüstü)*

9. Fatther's occupation: _____

(Babanızın mesleği)

10. Marital status: _____

(Medeni durumunuz)

11. If married, your spouse's education level:

(Evli iseniz eşinizin en son bitirdiği okul)

Elementary School *(İlkokul)* Middleschool *(Ortaokul)* Highschool *(Lise)* Undergraduate *(Üniversite)* Graduate *(Lisansüstü)*

12. Spouse's occupation: _____

(Eşinizin mesleği)

13. Number of children: a) 0 b) 1 c) 2 d) 3+

(Kaç çocuğunuz var?)

14. Where do you place your socio-economic status in Turkey?
(Türkiye genelinde değerlendirdiğinizde kendi ekonomik durumunuzu nasıl görüyorsunuz ?)

a) low income *(düşük gelir düzeyi)*
b)low-middle income *(düşük-orta gelir düzeyi)*
c)middle income *(orta gelir düzeyi)*
d) middle-high income *(orta-üst gelir düzeyi)*
e) high income *(üst gelir düzeyi)*

15. Total monthly income of your family: _____ TL
(Ailenizin toplam aylık geliri yaklaşık ne kadardır?)

16. How many people are there in your household? _____
(Bu gelir toplam kaç kişinin geçimini sağlamaktadır?)

17. Where do you spent most of your life? Please state as village, town, district and city. _____
(Hayatınızın en büyük bölümünü hangi şehirde geçirdiniz ? Köy, kasaba, ilçe, şehir olarak belirtiniz).

APPENDIX G

INSTRUCTIONS FOR VALENCE RATINGS

In this section we would like you to rate valence of the memories you reported.. If you think the memory is very negative please rate as 0 and if you think the memory is very positive please rate as 5.
(Bu bölümde sizden biraz önce yazdığınız anıların size göre ne kadar olumlu ya da olumsuz olduğunu değerlendirmenizi istiyoruz. Anıyı çok olumsuz buluyorsanız 0, çok olumlu buluyorsanız 5'i işaretleyiniz.)

ANI:

0	1	2	3	4	5
Very Negative *(Çok Olumsuz)*					Very Positive *(Çok Olumlu)*

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