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WHY DO WE REMEMBER OUR PAST?

AUTOBIOGRAPHICAL MEMORY FUNCTIONS IN DIFFERENT CONTEXTS

BY

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Thesis Abstract

Autobiographical memory has been conceptualized as an episodic memory system, representing specifically personally experienced events. The *self* plays a substantial role in the organization of autobiographical memories; in that, episodes of remembering enable us to evaluate past experiences and reflect upon them in the light of potentially changing context and the self. Accordingly, three studies in this dissertation focused on the individual differences in autobiographical remembering across different contexts. First, higher-order mechanisms of remembering were characterized and three memory components were proposed, indicating encoding, rehearsal and recollection. Then, individual differences in adult attachment were examined to test whether attachment anxiety and attachment avoidance was differentially reflected on the components of remembering. The link between attachment variables and recollection was fully mediated by either event features that represent the encoding process or the rehearsal mechanisms. More specifically, for attachment anxiety, individuals with high anxiety tended to rehearse relationship memories very frequently and that's why they recalled these memories in a very intense and vivid manner. Avoidant individuals, on the other hand, tended to limit the encoding process beforehand the memory gets intense, leading them to retain vague relationship memories, especially the positive ones.

The second study focused on the rehearsal function to characterize the role of distinct rehearsal patterns (i.e. involuntary and voluntary) in the way failures and achievements are represented over time. Ruminative tendency, as a construct, is very much related to rehearsal, and likely to determine what is to be consolidated in the memory. Therefore, specific forms of rumination, brooding and reflection, were investigated as an individual-difference variable to characterize their relative influence on the link between rehearsal and memory experience. Results showed the distinct functions served by voluntary and involuntary rehearsal. But more

importantly, the way each rehearsal function operated was distinguished in relation with ruminative tendencies, pointing out the individual differences in what is functional and how this variation shapes memory processes.

The third study specifically examined the emotion regulation function of autobiographical memory. After participants were induced negative emotions (i.e. sadness or anger), they were asked to report any random memory in order to test whether autobiographical remembering operates to down-regulate negative affect with the retrieval of more positive memories. It appeared that regulation of the sadness required the retrieval of more important memories whereas anger resulted in more intense recollection of events. Valence differences in the subsequent recall appeared when we considered how individuals were feeling after emotion induction. Supporting for a counter-regulation mechanism, the more negative individuals were feeling, the more positive memories they recalled subsequently. We observed individual differences in the efficacy of emotion regulation, such that, only the individuals with high reappraisal tendency recalled more important and emotionally intense memories in response to negative affect.

Overall, the three studies provided complimentary evidence explaining the link between the individual and autobiographical remembering from a functional perspective. What is functional may not be identical for every individual and every context, which underlines an idiosyncratic approach especially when studying memory functions. Especially the third study is novel as there has been no empirical evidence testing the regulatory function of remembering. Also, in terms of the methodology, we adopted a modelling approach in order to understand the dynamic interplay of the memory components. This further allowed us to figure out the causal

interactions between the individual and autobiographical remembering, which, we believe, has promising implications for the future research in autobiographical memory.

Tez Özeti

Otobiyografik bellek, episodik bellek sisteminin bir parçası olarak yaşadığımız olaylara ilişkin anılarımızı temsil etmektedir. Benlik de otobiyografik anılarımızın organizasyonunda oldukça önemli rol oynamaktadır; şöyleki, hatırlama deneyimi, yaşadıklarımızı yeniden değerlendirmemizi, benliğin ya da içinde bulunduğumuz ortamın koşullarına göre, geçmiş anılara dair bir perspektif geliştirmemizi sağlamaktadır. Bu bağlamda, doktora tezinin içerdiği üç çalışma farklı koşullarda, otobiyografik hatırlamadaki bireysel farklılıkları incelemeyi amaçlamaktadır. İlk çalışmada, belleğin ana kavramsal yapıları ayrıştırılmaya çalışılmış ve kodlama, tekrar, ve hatırlamaya karşılık gelen üç ayrı bellek mekanizması önerilmiştir. Ardından da, yetişkin bağlanma modellerinin, bağlanma kaygısı ve kaçınmanın, bellek üzerindeki etkisi bu üç ana mekanizma üzerinden incelenmiştir. Yapısal eşitlik modellemesi kullanılarak yapılan analizlerde, tekrar mekanizmasının, bağlanma kaygısının hatırlama üzerindeki etkisinde tam bir aracı rol oynadığı görülmüştür. Kaygılı bireyler ilişki anılarını sürekli istemli ya da istemsiz olarak hatırladıkları için bu anıların duygusal yoğunluğu yüksek ve canlı olmaktadır. Kaçınma için ise, hatırlama daha çok kodlama mekanizmalarından etkilenmektedir, yani bağlanma kaygısı yüksek bireyler, daha en başından ilişki anılarını pek önemsemezler ve bu nedenle bu anıların hatırlaması da güçsüzleşmektedir. Kaygı ve kaçınmanın bellek yapıları üzerindeki ilişki duygu düzenleme mekanizmaları ile oldukça ilişkili olduğu görüşmüş ve sonuçlar bu çerçevede tartışılmıştır.

İkinci çalışmada ise, aşarı ve başarısızlıklara ilişkin anılara odaklanılarak istemli ve istemsiz hatırlamanın farklı işlevleri incelenmiştir. Ruminasyonun, tekrar mekanizması ile oldukça ilintili olduğu göz önüne alınarak, ruminasyonun iki ayrı alt faktörü olan kuruntu (brooding) ve yansıtmanın (reflection), tekrar ve hatırlama üzerindeki spesifik etkilerinin belirlenmesi amaçlanmıştır. Beklendiği üzere, istemli ve istemsiz hatırlamanın farklı işlevleri olduğu görülmüştür. Ancak, daha da önemli olarak, bu işlevler, kuruntu ve yansıtma

düzeylerindeki farklılıklarla ilişkili olarak, başarı ve başarısızlıkların hatırlama süreçlerini farklı etkilemektedir. Bu da otobiyografik hatırlama sürecinde, neyin işlevsel algılandığı konusunda bireysel farklılıklara olduğunu göstermektedir.

Üçüncü çalışma ise, özellikle, belleğin duygu düzenleme işlevine odaklanmaktadır. Katılımcılar rastgele üç gruba atanmış ve iki farklı deney grubundan üzüntü ya da öfke ile ilişkili anılarını hatırlamaları istenmiştir. Üçüncü grup ise kontrol grubu olarak düşünülmüş ve günlük hayatlarından herhangi bir anı anlatmaları istenmiştir. İlk anı hatırlama aşamasından sonra her üç gruptan da akıllarına gelen herhangi bir anıyı hatırlamaları istenmiştir. İkinci aşamadaki hatırlamanın karakteristikleri incelendiğinde, üzüntü ile ilişkili anılar hatırlamış bireylerin ikincil hatırlamalarında daha önemli buldukları anılar hatırladıkları gözlenirken, öfkenin düzenlenmesi daha çok imgelem gibi anının canlılığı ile ilişkili özellikler ile sağlanmıştır. Bireyler arası yeniden değerlendirme (reappraisal) becerisindeki farklılıkların da duygu düzenleme işlevinde etkili olduğu gözlenmiştir.

Sonuç olarak, doktora tezi çerçevesinde incelenen üç çalışmada da otobiyografik hatırlama ve birey-çevre arasındaki işlevsel farklılıklar ortaya konmaktadır. Nasıl bir hatırlama biçiminin işlevsel olacağı bireyden bireye farklılık göstermektedir ki bu da özellikle bellek işlevleri çalışılırken bireysel etmenlerin göz önüne alınması gerektiğine işaret etmektedir. Ayrıca, farklı bellek yapılarının belirlenmesi, birey-hatırlama arasındaki dinamik ilişkinin çalışılabilmesi için özgün bir yaklaşım sunmaktadır.

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Sezin Öner
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INTRODUCTION

Autobiographical memory has been conceptualized as an episodic memory system, specifically representing personally experienced events. Multimodality of the information processed within this system distinguishes autobiographical remembering from any type of episodic memory (Rubin, 2005). Along with the explicit nature of retrieval (Tulving, 1973), as well as recollection, the *self* plays a substantial role in the organization of the autobiographical memory system (Conway & Pleydell-Pearce, 2000). More specifically, autobiographical memories are supported by the dynamic interplay of individual-context interactions. multiple mechanisms, each of which is modulated depending on the interactions between the individual and the environment. It is not only the event, the source of memory, that determines remembering, but also, factors associated with the 'rememberer', such as motivations and goals over time, shapes how the memory processes operate.

Autobiographical memory is central to individuals' functioning and orientation to the world. We retain past experiences to think back and use them for guiding the present and the future. On the other hand, it is not solely a system for storage, but episodes of remembering enable us to evaluate past experiences and reflect upon them in the light of potentially changing context and the self. After the initial encoding of an experience, a number of retrieval episodes enable to monitor and update the memory representation, which further influence subsequent remembering. The self is highly involved in all these processes in a way to inform the memory processes about 'the individual'. On the other hand, it is through a continuous feedback mechanism (Conway, 2005) that remembering also influences the individual. In short, autobiographical memory relies upon complex mechanisms, bridging the individual with its context in an adaptive manner.

Autobiographical memories are the product of distinct, yet related processes in which the *individual* has substantial role in the modulation of memory processes. One major question arises, that is how individual differences are reflected on memory processes. Whereas differences between individuals influence how they remember information, it is also as likely that remembering would influence behavior. In other words, if remembering influences the individual, then what we remember or the way we remember becomes an individual difference factor by itself, accounting for the variation in subsequent responses. Following this line of reasoning, it becomes essential to characterize the way individuals modulate remembering depending on the intended changes on behavior.

Building upon this framework, we argue that autobiographical memories can be considered as an interface regulating the interactions between the individuals' characteristics and their actions. More specifically, there exists individual-specific variables that influence remembering, however the pattern they influence distinct memory components may differ. In the present dissertation, three studies investigated the functional utilization of autobiographical remembering by investigating the interrelated processes between the individual, memory, and behavior.

In the first study, we characterized distinct components pertaining to the mechanisms involved in autobiographical remembering. We focused on the role of adult attachment in remembering memories of close relationships and, tested, the relative influence of attachment anxiety and avoidance on distinct memory components. In the second study, our goal was to understand the role of rehearsal mechanisms in the way past events are represented. We focused on memories associated with important personal goals which either individuals successfully achieved or failed to achieve. In addition, as rumination is very much related to rehearsal

(Thomsen, 2006), we also tested individual differences in rumination, to characterize the association between distinct forms of rumination, specifically brooding and reflection, and memory experience in relation with rehearsal patterns. In the first two studies, we examined how distinct memory components are modulated for the memory experiences to be more adaptive for the individual. Relying upon these studies, in the third study, we aimed to directly test the functional use of autobiographical memory. In doing so, we focused on the emotion regulatory function and investigated the extent individuals utilize autobiographical remembering to regulate their affective states.

Overall, we argue that the way one remembers is as important as what is remembered, both of which may influence the function that the memory serves for the individual. We emphasize the multimodal nature of autobiographical memory in all three studies, and within a functional perspective; we attempt to characterize how modulation of distinct memory components contribute to the adaptive nature of memory.

CHAPTER I

Latent Constructs Model Explaining the Attachment-Linked Variation in Autobiographical Remembering

Abstract

In the current study, we proposed a latent constructs model to characterize the qualitative aspects of autobiographical remembering and investigated the structural relations in the model that may vary across individuals. Primarily, we focused on the memories of romantic relationships and argued that attachment anxiety and avoidance would be reflected in the ways that individuals encode, rehearse, or remember autobiographical memories in close relationships. Participants reported two positive and two negative relationship-specific memories and rated the characteristics for each memory. As predicted, the basic memory model yielded appropriate fit, indicating that event characteristics (EC) predicted the frequency of rehearsal (RC) and phenomenology at retrieval (PC). When attachment variables were integrated, the model showed that rehearsal mediated the link between anxiety and PC, especially for negative memories. On other hand, for avoidance EC was the key factor mediating the link between avoidance and RC, as well as PC. Findings were discussed with respect to autobiographical memory functions emphasizing a systematically, integrated framework.

Keywords: Autobiographical memory, Adult attachment, Phenomenology, Latent constructs,

Latent Constructs Model Explaining the Attachment-Linked Variation in Autobiographical Remembering

Autobiographical memory can be defined as a multimodal representation of personal experiences that typically includes various sensory-perceptual and emotional features as well as subjective evaluations (Rubin, 2006). Autobiographical remembering is not just a recollection of past events, but rather, it is a process composed of independent but interrelated mechanisms operating throughout the duration between encoding and retrieval. How well an event will be remembered is dependent upon how well it has been encoded and retained. In addition to the meaning attributed to the event, the frequency and the nature of rehearsal have substantial roles in the memory experience at the time of retrieval.

Encoding, rehearsal, and retrieval processes in autobiographical memory do not operate in vacuum, but they interact reciprocally with the *self* system in a way to preserve continuity in an individual's life (Bluck, Alea, Habermas, & Rubin, 2005). More specifically, encoding and rehearsal processes, as well as what will be retrieved and in what form, are regulated in accordance with goals or expectations (Conway, 2005). If an event includes self-discrepant information, one may attenuate the personal significance of an event and tend to recall the event less frequently. However, it is also possible for this person to put much effort to think and talk about the event in order to resolve the discrepancy. Therefore, it is very likely that there exist individual differences in encoding, rehearsal, and retrieval processes all of which dynamically interact with the self in the organization of autobiographical memory (Conway, 2005; Holland & Kensinger, 2010).

In the present research, we aimed to understand how individual differences in self-representations interact with distinct memory processes. As an instance of the relationship between such processes and autobiographical memory, we focused on memories of romantic

relationships, and considering attachment representations as a relevant individual-differences factor in relational contexts, we investigated whether attachment anxiety and attachment avoidance have unique effects on memory qualities, reflecting the distinct self-regulatory goals associated with attachment representations.

In the following sections, we overview the latent constructs that constitute key components of autobiographical memory and then we discuss potential functions underlying the individual variation in distinct mechanisms of remembering, focusing especially on the changes in memory processes associated with attachment representations.

The Conceptual Model for the Phenomenology of Remembering

In many studies of autobiographical memory (e.g., D'Ambargeau & van den Linden, 2006; Hall & Berntsen, 2008; Berntsen & Bohn, 2009), the common approach has been to consider each memory characteristic individually. Here, we argue that it is important to distinguish these characteristics on the basis of the relevant memory processes to understand the causal connections between these processes. Although each characteristic provides unique information for the memory, examination of individual elements irrespective of the broad context and the commonalities between them may limit our understanding. Therefore, we employed a modeling approach in the current study. Employing a modeling approach enables us to detect systematic changes in remembering, particularly when testing the memory processes in relation to any independent factor (e.g. individual or contextual differences).

In their recent work, Fitzgerald and Broadbridge (2013) emphasized the necessity to identify the measurement structure as well. They proposed a four-factor model in which impact of the event, rehearsal, recollection and belief constitute the higher-order constructs of remembering. The model conceptualized recollection and belief as distinct constructs and tested the features predicting these two components of retrieval. In general, whereas rehearsal

specifically predicted the belief regarding the memory, impact of the event was linked to both recollection and belief.

Recollection is an integral component of retrieval and researchers considered emotional and perceptual imagery to be key properties of recollection. In a similar vein, temporal and spatial information act as event markers in memory (Shum, 1998) and aid recollection. Moreover, inclusion of further perceptual (e.g., auditory) details fosters the recollection of the original experience (Noesselt, Bergmann, Hake, Heinze, & Fendrich, 2008). Emotional intensity, as well as, attention processes at the time of encoding form the initial event representation, which is integrated with subjective attributions regarding the experience. Detailed memory representations become the source on which recollection occurs (Rubin, 2006). Similarly, belief judgments rely on recollective experience such that coherence of the retrieved information determines confidence in memory (Rubin, Schrauf, & Greenberg, 2003). In addition to the recollective experience multiple sources of metacognitive information support autobiographical belief. However, although event details may not be accurately remembered, individuals tend to report high confidence for their memories (Talarico & Rubin, 2003, 2007). Other evidence also showed that belief in the occurrence of an event could be altered using social manipulation (Scoboria, Mazzoni, Kirsch, & Relya, 2004). It is also likely that the way memories are narrated has an important role in belief judgments (Habermas & Diel, 2013; Rubin & Siegler, 2004) such that reasoning over experiences leads the memory to be represented as gist information. Even under these circumstances when details are eliminated, the individual may hold strong beliefs regarding that memory experience. In many cases, the memory becomes semanticized, and stored at a conceptual level in the memory system. Therefore, here we argue for the heterogeneity of the belief construct, and rather than being an inherent component of autobiographical remembering, belief reflects the metacognitive processes relying upon the output of the memory experience.

Building on previous work, we propose a model to characterize the latent constructs of memory characteristics in a way to demonstrate how individual-specific factors differentially influence the general structure of remembering. In doing so, we considered mainly the temporal relations among the factors forming the higher-order memory constructs. More specifically, three latent factors were proposed, each of which reflect memory representations at distinct time points. Event Characteristics (EC) factor represents the actual experience and is associated with the time of encoding. Phenomenological Characteristics (PC) factor combines the sensory-affective features associated with the experience of retrieval. Finally, Rehearsal Characteristics (RC) factor is about the repeated recollection and reconstruction of the experience by thinking and talking during the time between encoding and retrieval.

We argue that the event characteristics (EC) constitute the crucial features that determine the function of the memory in particular contexts. Personally meaningful memories, especially the positive ones, are remembered more frequently by means of both internal talk and sharing with others, which help the individual to maintain self-continuity, and to develop intimacy in social relationships (Wilson & Ross, 2003; Alea & Bluck, 2007). Voluntary rehearsal also serves the function of directing the individual's future behaviors such that by reminiscing about previous experiences and taking lessons from them, the individual may modify future behaviors so as to match with current goal states (Rasmussen, & Berntsen, 2009b). Therefore, the amount of remembering depends on the initial encoding features and subjective meaning of the event, with more frequent remembering resulting in further consolidation and reconstruction of the memory (Walker, Skowronski, Gibbons, Vogl, & Ritchie, 2009). Regarding the phenomenology of remembering, it is important to consider both the event (EC) and rehearsal characteristics (RC). As reported in numerous studies (e.g. Talarico, Labar, & Rubin, 2004; D'scArgembeau, Comblain, & van den Linden, 2003; Rasmussen & Berntsen, 2013), events that were encoded

with more emotional intensity were also remembered more vividly and intensely, and the events that were rehearsed more often tended to be remembered in more detail with more reliving features (Suengas & Johnson, 1988). In congruence with these findings, we predicted that, event characteristics during encoding and the amount of rehearsal in between encoding and rehearsal would contribute to the recollective features at the time of retrieval (Rasmussen & Berntsen, 2009b; Walker et al., 2009).

Autobiographical Remembering in Self Regulation

Self-knowledge is one aspect of autobiographical memory and how we remember our experiences is interrelated with how we define our self (Conway, 2005). Bluck (2003) indicated self function as one of the three functions of autobiographical memory. Autobiographical memory continually interacts with the self and the environment in order to provide a sense of continuity and coherence between past, present, and future (Conway, 2005; Bluck & Habermas, 2000). Self-regulation has been considered to be an important aspect of the self-function (Pasupathi, 2003). Depending on the self-regulatory goals, memory processes may be altered to allow active goal-pursuit (Conway, 2005; Sutin & Robins, 2005) such that in order to regulate the anticipated negative affect, individuals may reduce the emotional intensity associated with the event (Sutin & Rubins, 2008). Similarly, it was also observed that, in order to promote a positive self-view, positive memories are more likely to be maintained and may be perceived as even more positive over time. It is important to note that this observation was more pronounced among high self-esteem individuals, pointing out how individual differences interact with the functions of autobiographical memory (Christensen, Wood, & Feldman Barrett, 2003).

The basic premise of the functional approach is that memories are organized and retrieved in the way they are because they serve particular functions for the individual (Rasmussen &

Berntsen, 2009b; Bluck, Alea, & Demiray). Because 'what is functional' differs across individuals, variation in individuals' goals and expectancies is reflected on encoding, rehearsal, and retrieval processes. We argue that when remembering events of a relationship, attachment styles constitute a major factor that resides within the individual moderating autobiographical remembering.

Conway, Singer and Tagini (2004) argued that, attachment related internal working models (IWMs) that were suggested by Bowlby (1979) are schema-like structures, acting as regulatory agents. They influence the salience of the attachment related information in the memory system or alter the motivational value of retrieval. Through these processes, they provide the individual a self- or relational narrative that is coherent with their attachment representations. On the other hand, the functionality of remembering depends on one's existing schemata for close relationships. In other words, what will be functional for the individual may vary depending on the levels of anxiety and avoidance in IWMs. Regulatory strategies may operate early in the activation of the attachment system as a form of attentional deployment and cognitive change (Shaver & Mikulincer, 2007), resulting in discounting the significance of the event at the time of the experience. Alternatively, affective responses may be suppressed, and phenomenology of remembering during rehearsal or retrieval is targeted.

Adult Attachment and Self-Regulatory Function

Attachment theory (Bowlby, 1979) suggested that through interactions with significant others, individuals build mental models representing both self and others in relational contexts. These mental models, as Bowlby called *internal working models* (IWMs, Bowlby, 1973, 1979), act as relational schemas through which individuals develop particular beliefs, expectations, and affect-regulatory strategies in attachment relationships. IWMs are characterized by two independent but related constructs of attachment (Brennan, Clark, & Shaver, 1998; Fraley,

Waller, & Brennan, 2000). *Attachment avoidance* refers to the extent that the individual feels uncomfortable with intimacy, leading to indifference and emotional distance in close relationships. The other dimension, *attachment anxiety*, reflects the extent to which the individual feels extreme worry of others' availability and fear of rejection, resulting in overdependence and also heightened vigilance to relational threats.

Considering IWMs to be conceptually similar to cognitive schemas, Mikulincer and Shaver (2007) suggested that these models contain generic information and strategies for self-regulation. Regulatory strategies associated with anxiety and avoidance are typically characterized by hyperactivation and deactivation of the affective states respectively. Although the strategies may differ, both serve self-coherence as well as the reduction in the uncertainty about relational threats. Memory-related processes also function accordingly, such that, for highly anxious individuals, active maintenance of negative information impairs balanced allocation of cognitive resources, leading to selective, but in general intrusive, recall (Mikulincer, Dolev, Shaver, 2004) as well as persistence of memories (Pereg & Mikulincer, 2004; Mikulincer, Birnbaum, Woddis, & Nachmias, 2000). Studies on remembering of relationship-related memories indicated that individuals with high attachment anxiety were faster to recall negative, rather than the positive, experiences with attachment figures (Mikulincer & Orbach, 1995; Gentzler & Kerns, 2006). Also, these memories were accompanied by intense negative affect and intrusive cognitions (Mikulincer et al., 2004).

Attachment avoidance is associated with deactivating strategies which result in denial of attachment needs, avoidance of emotional involvement and intimacy, and discounting attachment-related experiences (Mikulincer & Shaver, 2003, 2007). This could be thought of as *shutting down the system* to avoid the *expected* negative consequences. Memory research on attachment avoidance has demonstrated that it leads to slower and less-detailed recall of

relational experiences (Mikulincer & Orbach, 1995). Several other studies addressed the mechanisms of avoidance-related changes in memory, suggesting the effects of either a pre-regulatory mechanism specific to encoding or a post-regulatory mechanism blocking retrieval (Edelsten, 2006; Edelstein & Gillath, 2008). Kohn, Rholes, and Schmeichel (2012) emphasized the role of mechanisms at the time of retrieval such as active suppression,. However, in another study, when the retrieval motivation was manipulated by rewards, contrasting findings were observed (Fraley & Braumbaugh, 2007). The results showed that highly avoidant individuals experienced substantial difficulty in recalling attachment-related information even when they were given monetary reward for the amount of recall. The discrepancy in these findings may be a function of employing different dependent variables, i.e., latency (Kohn et al., 2012) and amount of detail (Fraley & Braumbaugh, 2007). It is possible that although highly avoidant individuals do retrieve a memory to report, the quality of the retrieval, even for positive experiences, may be poorer compared to low avoidant individuals.

Although there have been a number of studies (Mikulincer & Orbach, 1995; Kohn et al., 2012; Fraley & Brumbaugh, 2007) addressing the notion of attachment representations as schematic guidelines for processing relational information, memory research has primarily focused on the content or valence of the attended or retrieved stimuli. In this study, we focus on qualitative aspects of autobiographical remembering in order to understand the specific mechanisms on which anxiety and avoidance operate.

Present Research

Our primary concern in this study was to identify how individual-specific variables interacted with memory components in the context of relationships. We included anxiety and avoidance as individual-difference factors and tested how they moderated the relationships between characteristics of the event, rehearsal, and retrieval. We chose to examine positive and

negative memories separately because there is considerable evidence for individual differences in the retrieval of positive and negative autobiographical memories (D'Argembeau & Van der Linden, 2006; Rasmussen & Berntsen, 2013; Finnbogadóttir & Berntsen, 2011). After ensuring the validity of the model with expected causal links for positive and negative memories, we then proceeded to testing the role of attachment-related variation in memory processes.

For negative memories, we expected that both attachment anxiety and avoidance would be positively associated with both event characteristics and rehearsal characteristics, which would, in turn, be reflected upon the phenomenological characteristics. However, we expected a larger effect of attachment anxiety and avoidance for positive memories since these memories conflict with the existing schemas. In that sense, they might be rehearsed less and discounted, resulting in poorer memory quality at retrieval.

In addition, we argued that the amount of rehearsal might be the mediating variable between memory age and phenomenological characteristics as the duration between encoding and retrieval affects the potential to rehearse. Therefore, particularly for negative memories, we expected less rehearsal with increasing time after an event, resulting in decreases in sensory imagery at recall. On the other hand, positive memories may serve the function of self-coherence or social bonding (Bluck et al., 2010; Demiray & Bluck, 2011; Rasmussen & Berntsen, 2009a), and therefore the fading effect of time on phenomenological characteristics may be reduced.

Method

Participants

The participants of the study were 113 (67 female, 46 male) undergraduate students at Koç University who ranged in age between 19 and 24 (M = 20.88, SD = 1.11). Forty-seven percent of the sample (N = 48) were currently in a romantic relationship and indicated the mean duration of their relationship as 22.52 months (SD = 22.16). The remaining participants (N = 57)

reported that they had been in a romantic relationship previously with a mean duration of 15.05 months (*SD* = 14.82). The remaining 8 participants were excluded because they indicated that they had never been in a relationship.

Measures

Experiences in Close Relationships – Revised (ECR-R; Fraley, Waller, & Brennan, 2000). The ECR-R is a 36-item measure assessing adult romantic attachment in two dimensions (anxiety and avoidance). Attachment anxiety subscale includes 18 items measuring individuals' confidence about the availability of their partners (i.e. "I often worry that my romantic partner doesn't really love me") and attachment avoidance subscale includes 18 items measuring the individual's sense of security in relying on their partners (i.e. "I find it difficult to allow myself to depend on romantic partners"). Participants were given the Turkish adaptation of the scale (Selçuk, Günaydın, Sümer, & Uysal, 2005) and they were asked to think about their overall experiences in romantic relationships by indicating how much they agreed with the given statements on a 7-point scale. The Turkish version of the ECR-R subscales demonstrated high levels of internal consistency (with Cronbach alphas of .87 and .89 for anxiety and avoidance subscales, respectively).

Memory Characteristics Questionnaire (MCQ; Johnson, Suengas, Foley, & Raye, 1988). Participants completed a modified version of MCQ for each memory they had reported. This version included 12, 5-point Likert-type scale, items, where participants rated event characteristics (emotional intensity of the event, consequentiality, self-definition, importance, valence), rehearsal frequencies (involuntary thinking, voluntary thinking, talking), and phenomenology of retrieval (emotional intensity at retrieval, vividness, auditory imagery, and visual imagery).

Procedure

The data were collected using an online survey software, Qualtrics (2013, Provo, UT). Participants first received a short survey consisting of questions about their romantic relationship status. Participants who were or had been in a romantic relationship completed the ECR-R. They were then asked to report a specific, negative (positive) memory they experienced in their current (if they were not in one, previous) romantic relationships in as much detail as possible. After they reported the memory, participants rated the MCQ items and proceeded to the subsequent memory report. This request was repeated three more times such that in total, they reported two negative and two positive memories. The order of positive and negative memories were counterbalanced such that half the participants reported them in the PNPN order and the other half reported their memories in reverse order (NPNP). The study was completed in approximately 45 minutes and all the participants received course credit in exchange for their participation.

Results

Data from 12 participants were excluded from the sample (4 female, 8 male) because they provided less than 2 usable memories (i.e., they could not remember any events or they provided irrelevant memories). The final sample consisted of 93 participants who showed similar demographic characteristics as the excluded cases (*p*s > .05).

Comparison of memories based on valence and type

The first set of analyses was on memory qualities to examine whether there were any differences between a) first reported and second reported memories, b) memories of positive and negative valence, and c) memories for current and previous relationships. A separate three-way mixed ANOVA was conducted for each event characteristic, with memory type as the between-subjects factor and valence and order as the within subjects factors. Table 1 presents the means and standard deviations of memory characteristics at each level. The effect of order was found to be significant for event importance, $F(1, 91) = 11.90$, $MSE = 4.99$, $p = .001$, and event intensity,

$F(1, 91) = 16.68$, $MSE = 12.12$, $p < .001$. Those memories reported first ($M = 3.71$, $SD = .09$) were judged to be more important than second memories ($M = 3.35$, $SD = .09$) and the emotional intensity at the time of the event was rated higher for first memories ($M = 4.46$, $SD = .06$) than second memories ($M = 4.23$, $SD = .07$). As the instructions required more important and emotional events to be reported first, this result was expected. Valence of the event led to a difference in the importance of the event, $F(1, 91) = 14.67$, $MSE = 14.71$, $p < .001$, current emotional intensity, $F(1, 91) = 13.36$, $MSE = 17.14$, $p < .001$, and the ratings of visual reliving, $F(1, 91) = 4.94$, $MSE = 3.76$, $p < .029$, and vividness, $F(1, 91) = 5.36$, $MSE = 5.40$, $p < .023$, as well as involuntary rehearsal, $F(1, 91) = 8.60$, $MSE = 8.62$, $p = .004$. The effect of relationship type was significant for most characteristics, such that for memories of current relationships, individuals reported higher emotional intensity at retrieval, $F(1, 91) = 14.54$, $MSE = 42.37$, $p < .001$, higher vividness, $F(1, 91) = 6.90$, $MSE = 17.73$, $p = .01$, importance, $F(1, 91) = 5.76$, MSE = 14.45, $p = .018$, .05, and more frequent involuntary rehearsal, $F(1, 91) = 6.96$, $MSE = 22.33$, $p = .01$, compared to memories of previous relationships. The interaction between relationship type and valence was found to be significant for current emotional intensity, $F(1, 91) = 16.79$, $MSE = 21.55$, $p < .001$. Tukey's HSD test indicated that positive memories of current relationships ($M = 3.76$, $SD = 1.12$) were remembered with higher emotional intensity than both negative memories of current relationships ($M = 2.92$, $SD = 1.29$), and positive ($M = 2.71$, $SD = 1.23$) and negative memories ($M = 2.65$, $SD = 1.21$) of previous relationships.

Latent Constructs Model of Autobiographical Remembering

In order to identify the mechanisms underlying the phenomenology of remembering, we first tested the structure of the conceptual model of remembering. Next, we explored how distinct memory mechanisms operate in relation to attachment variables. In doing so, we tested a

Table 1.

Means and Standard Deviations of Memory Characteristics

	Current Relationships				Previous Relationships			
	Negative Memories		Positive Memories		Negative Memories		Positive Memories	
	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report
Event Intensity	4.40 *(0.90)*	4.00 *(1.16)*	4.51 *(0.66)*	4.32 *(0.96)*	4.34 *(0.94)*	4.04 *(0.96)*	4.20 *(0.94)*	4.06 *(0.13)*
Current Intensity	2.82 *(1.31)*	3.02 *(1.28)*	3.83 *(1.13)*	3.68 *(1.12)*	2.64 *(1.33)*	2.67 *(1.09)*	2.68 *(1.19)*	2.75 *(1.29)*
Vividness	3.60 *(1.15)*	3.23 *(1.15)*	3.94 *(0.99)*	3.64 *(1.21)*	3.09 *(1.15)*	3.14 *(1.13)*	3.32 *(1.19)*	3.25 *(1.19)*
Auditory Reliving	3.13 *(1.45)*	3.04 *(1.41)*	3.36 *(1.17)*	3.32 *(1.37)*	2.59 *(1.22)*	2.96 *(1.12)*	2.86 *(1.20)*	2.87 *(1.22)*
Visual Reliving	4.00 *(1.08)*	3.88 *(1.06)*	4.26 *(0.77)*	4.19 *(1.21)*	3.73 *(1.05)*	3.67 *(0.04)*	3.98 *(1.05)*	3.80 *(1.04)*
Self-Definition	2.74 *(1.19)*	2.90 *(1.22)*	2.91 *(1.15)*	2.91 *(1.34)*	2.50 *(1.14)*	2.49 *(1.16)*	2.48 *(1.19)*	2.69 *(1.30)*
Consequentiality	3.09 *(1.40)*	3.00 *(1.29)*	3.34 *(1.20)*	3.04 *(1.33)*	3.16 *(1.24)*	2.95 *(1.21)*	2.77 *(1.32)*	2.81 *(1.36)*
Valence	1.91 *(1.06)*	1.83 *(0.72)*	4.66 *(0.52)*	4.40 *(0.92)*	1.79 *(0.85)*	1.81 *(0.09)*	4.04 *(0.89)*	4.24 *(0.69)*
Involuntary Thinking	2.87 *(1.39)*	2.73 *(1.08)*	3.17 *(1.20)*	3.11 *(1.34)*	2.54 *(1.13)*	2.30 *(0.98)*	2.46 *(0.97)*	2.78 *(1.16)*
Voluntary Thinking	2.98 *(1.39)*	2.90 *(1.06)*	2.94 *(1.31)*	3.06 *(1.29)*	2.80 *(1.12)*	2.56 (1.07)	2.71 *(1.09)*	2.75 *(1.11)*
Talking	2.70 *(1.23)*	2.67 *(1.14)*	2.83 *(1.26)*	2.66 *(1.29)*	2.66 *(1.37)*	2.44 *(1.10)*	2.32 *(1.08)*	2.40 *(1.11)*
Importance	3.64 *(1.21)*	3.15 *(1.15)*	4.04 *(1.04)*	3.83 *(1.13)*	3.41 *(1.15)*	2.95 *(1.10)*	3.34 *(1.21)*	3.31 *(0.06)*
Memory Age[a]	13.77*(12.86)*	17.44*(20.07)*	11.89*(11.14)*	18.36*(18.29)*	26.80*(21.53)*	27.70*(20.36)*	26.38*(18.32)*	24.69*(19.89)*

Notes. [a]Number of months since the event

mediation model with structural equation modeling, which revealed anxiety- and avoidance-specific mechanisms involved in remembering memories of relationship events.

As a preliminary analysis, we examined the relationships among the variables that were tested in the model. As presented in Table 2 for negative memories and in Table 3 for positive memories, correlations were moderate to high in magnitude. In the next step, we tested the three latent constructs of autobiographical memory, which distinguished encoding, rehearsal and retrieval processes. We first conducted confirmatory factor analyses (CFA) to ensure whether the measurement model with three latent constructs fits the data and further investigated the structural relations that characterize autobiographical remembering. Considering different functions of positive and negative memories for individuals with different attachment representations, we tested measurement and structural invariance across memory types, which enabled us to make meaningful comparisons in subsequent analyses for the complex model.

We used the structural equation modeling approach (SEM) with AMOS 21.0 Absolute and incremental fit indices were used to assess model fit. Absolute fit indices represent how well the a priori model fits, and among several absolute fit indices, we focused on Root Mean Square Error of Approximation (RMSEA), and Minimum Fit Function Chi-Square. However, with large sample sizes, it is very likely that chi-square value would be inflated and in such cases RMSEA was found to provide more reliable results. When using RMSEA, values below 0.08 were considered fair fit whereas values below 0.05 were considered close fit (Browne & Cudeck, 1992). For the incremental fit indices, we included Comparative Fit Index (CFI) and Non-normed Fit Index of which values above 0.90 indicate good fit (Bentler, 1990). Also, for the comparison of nested models, we used the conventional criteria such that changes in the CFI, NNFI, or RMSEA of 0.01 indicated significant change in the fit of different models (Wideman, 1985).

Table 2. *Correlations of Negative Memory Characteristics with Attachment Variables*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Anxiety	1	.46**	.05	.18**	.24**	.17*	.14*	.09	.10	-.06	.24**	.18*	.06	.08	.00
2. Avoidance		1	-.13	-.08	-.02	-.05	-.09	-.05	-.10	.09	-.08	-.11	-.10	-.15*	.21**
3. Event Intensity			1	.42**	.45**	.30**	.44**	.16*	.33**	-.50**	.22**	.28**	.17*	.36**	-.04
4. Current Intensity				1	.70**	.49**	.38**	.31**	.48**	-.30**	.64**	.53**	.33**	.45**	-.23**
5. Vividness					1	.61**	.51**	.42**	.46**	-.29**	.56**	.47**	.34**	.42**	-.21**
6. Auditory Imagery						1	.51**	.17*	.18*	-.19*	.34**	.25**	.19*	.11	-.09
7. Visual Imagery							1	.23**	.32**	-.25**	.27**	.30**	.21**	.35**	-.14*
8. Self Definition								1	.41**	-.12	.38**	.28**	.26**	.42**	-.12
9. Consequentiality									1	-.27**	.54**	.52**	.37**	.67**	-.07
10. Valence										1	-.24**	-.34**	-.24**	-.32**	.03
11. Involuntary Thinking											1	.77**	.45**	.55**	-.19*
12. Voluntary Thinking												1	.60**	.60**	-.16*
13. Talking													1	.40**	-.15*
14. Importance														1	-.13
15. Memory Age															1

*p <.05, **p < .01

Table 3. *Correlations of Positive Memory Characteristics with Attachment Variables*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Anxiety	1	.44**	-.02	-.02	.10	.16*	.08	.06	.08	-.08	.15*	.12	.12	-.03	.01
2. Avoidance		1	-.23**	-.28**	-.18*	-.04	-.23**	-.06	-.17*	-.30**	-.11	-.13	-.14	-.28**	.09
3. Event Intensity			1	.48**	.50**	.43**	.48**	.19**	.37**	.40**	.40**	.36**	.29**	.57**	-.03
4. Current Intensity				1	.66**	.48**	.50**	.33**	.46**	.37**	.51**	.44**	.36**	.51**	-.21**
5. Vividness					1	.62**	.60**	.32**	.37**	.36**	.52**	.48**	.40**	.44**	-.16*
6. Auditory Imagery						1	.51**	.17*	.22**	.27**	.38**	.28**	.21**	.27**	-.09
7. Visual Imagery							1	.26**	.27**	.34**	.43**	.37**	.33**	.43**	-.17*
8. Self Definition								1	.51**	.17*	.44**	.33**	.26**	.32**	-.08
9. Consequentiality									1	.34**	.48**	.46**	.36**	.56**	-.01
10. Valence										1	.30**	.22**	.19*	.50**	-.15*
11. Involuntary Thinking											1	.74**	.52**	.57**	-.19*
12. Voluntary Thinking												1	.66**	.56**	-.06
13. Talking													1	.36**	-.08
14. Importance														1	-.09
15. Memory Age															1

* p <.05, ** p < .01

The variables that are subsumed under Event characteristics (EC), Rehearsal Characteristics (RC), and Phenomenological Characteristics (PC) are shown in the Appendix. EC, RC, and PC were not only distinguished by qualitative features of the memory they represented, but they also represented memory processes at different points in time.

Confirmatory Factor Analysis and Testing Measurement Invariance. Confirmatory factor analysis (CFA) of the three-factor model distinguishing EC, RC, and PC, provided substantially better model fit than the single factor model. Change indices revealed that freeing particular covariances would notably change the model fit, therefore, covariances were included in the model for the ones that were theoretically sound, resulting in a decrease in chi-square by about 96.53, leading to χ^2 = 108.791 (38), CFI = .964, NFI = .948, RMSEA = .071 (Model 2)**.** In addition, independent CFAs with positive (Model 3) and negative memories (Model 4) confirmed that the measurement model fits the data well.

Measurement Invariance across memory types. We first established form or pattern invariance (see Table 4, Model MI_a, χ^2 = 220.866*(78)* (47), CFI = .930, NFI = .917, RMSEA = .069), indicating similar patterns of item to construct relationships independently of the valence of the memory.

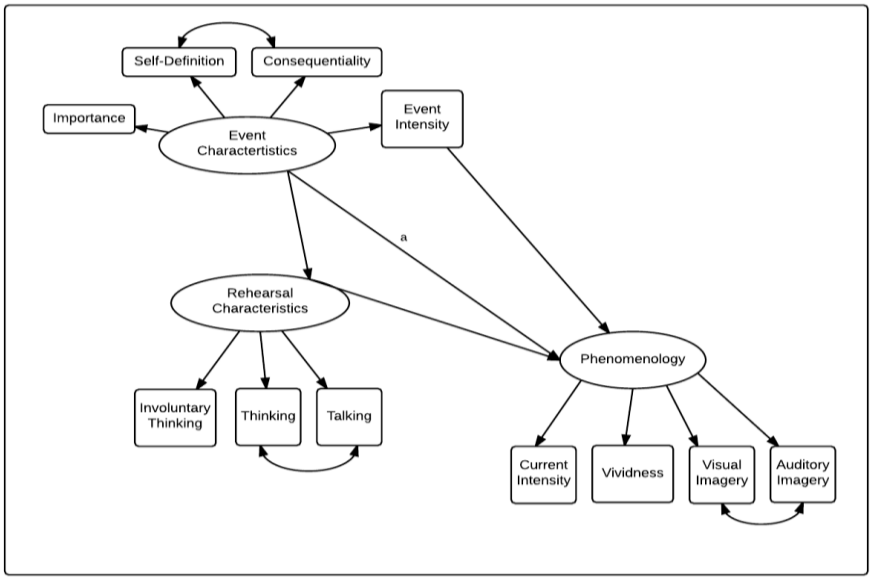
Measurement invariance was further assessed in several more steps (van de Schoot, Lugtig, & Hox, 2012). First, in two steps, we constrained factor loadings (metric invariance), and then also the intercepts (scalar invariance) to be equal across groups. Compared to the pattern invariant model, factor invariance (Model MI_b) did not result in significant change in model fit, Δ χ^2 = 7.745 (8), CFI = .924, NFI = .891, RMSEA = .067. Scalar invariance in the model (Model MI_c) resulted in significant change in chi-square, however, other fit indices changed modestly. It has been suggested that significant increases in chi-square is expected when many parameters are constrained (Little, 1997), therefore considering CFI, NNFI, and RMSEA, we accepted the scalar

invariance in the measurement model. This indicated that representation of each item in the latent construct was similar for positive and negative memories[1].

Table 4. *Model Fit Indices for Confirmatory Factor Analyses, Measurement Invariance and Structural Model*

	ChiSqu*(df)*	CMIN	CFI	NNFI	RMSEA	TIL	AIC	BIC
CFA								
Model	205.327*(41)*	5.008	.919	.901	.104	.891		
Model-Rev	108.791*(38)*	2.940	.964	.948	.071	.947		
Positive	70.315 *(38)*	1.850	.978	.947	.063	.954		
Negative	97.628*(38)*	2.639	.940	.914	.081	.911		
Measurement Invariance								
Pattern	220.866*(78)*	2.832	.930	.917	.069	.901	372.866	383.320
Factor	228.611*(86)*	2.658	.930	.913	.067	.910	364.611	373.964
Scalar	249.087*(94)*	2.650	.924	.910	.067	.911	369.087	377.340
Error	272.451(104)	2.620	.917	.901	066	.912	372.451	379.328
Structural Equivalence								
Memory	186.110*(102)*	1.825	.959	.926	.047	.947		
Attachment&Memory	220.351*(136)*	1.620	.961	.928	.040	.948		

Structural Equivalence of the Model of Remembering. The structural baseline model in Figure 1 was tested by keeping the factor loadings invariant across groups. In addition to the estimated links between latent constructs, we added a causal link between the event intensity and the latent factor, PC. Event intensity is a component of EC as a feature inherent in the experience itself, but it also accounts for much of the affective component of the memory, which is linked to not only emotional intensity at retrieval but also the recollective features in general.



[a]The link was insignificant for negative memories.

Figure 1. . Latent construct model of autobiographical memory

Furthermore, in order to eliminate the time-linked variation in memory characteristics, we integrated memory age into the model to investigate whether passage of time differentially influenced the memory quality. We predicted that time was more likely to be associated with RC and PC, rather than event-specific features. The time between encoding and retrieval corresponds to the temporal space that an event can be rehearsed, and if an event is rehearsed more frequently during this period, it is likely for the memory to be recalled better. On the other hand, some experiences may not require frequent rehearsal for a qualitatively good recall (Talarico et al., 2003; Rasmussen & Berntsen, 2013), therefore, we tested whether the relative influence of the passage of time on the latent constructs of rehearsal and phenomenology differed for negative and positive memories.

We estimated six directional pathways and three correlations between error variances in the structural model. The structural equivalence model (see Table 4, Model 5) yielded good fit

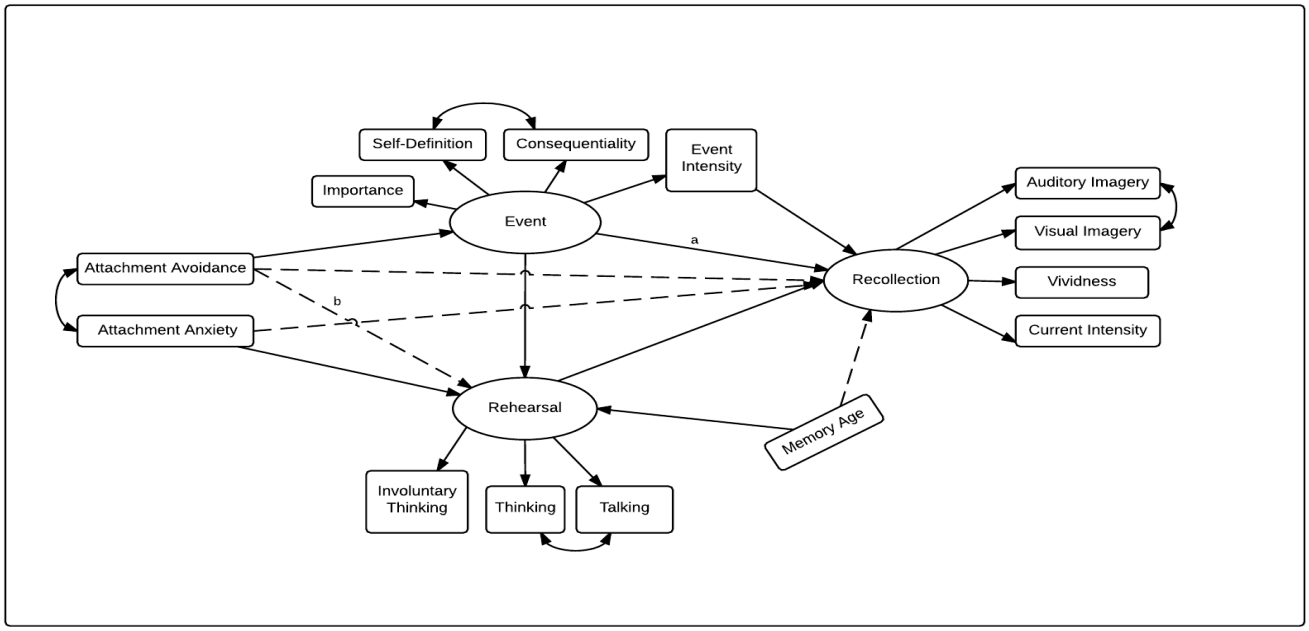
for both memory types χ^2= 172.404*(84) (84)*, CFI = .956, NNFI = .926, RMSEA = .053**.** Significant covariances between the residual terms of auditory and visual imagery were found only for negative memories, and self-definition and consequentiality correlated significantly, only for positive memories. All structural pathways were significant, except the link from EC to PC for both memory types. This indicated that event intensity, rather than importance, consequentiality or self-definition, predicted phenomenological characteristics**.** In addition, independent of the memory valence, RC mediated the link between retrieval phenomenology and memory age, suggesting that memories did not simply become more vague in time but rather less rehearsal resulted in less clear memories.

Structural Model of Remembering Embedded with Individual-Specific Factors. Having established the equivalence of the structural model for positively and negatively valenced memories, we integrated attachment anxiety and avoidance to the model and proceeded to examine how individual differences in attachment representations influence the pattern of structural relations in the model.

Mediation analyses were conducted to investigate potential interactions between anxiety or avoidance with the EC and MC for their relative effects on PC. Direct and indirect effects were tested with the Bootstrapping method that has been suggested as a more reliable and practical method (Baron & Kenny, 1986, see Shrout & Bolger, 2002, for a detailed discussion). We requested 1000 bootstrap samples, generating bias-corrected percentile-based bootstrap with 95% confidence intervals.

The overall fit of the final model (see Figure 2, Model 6) resulted in adequate fit for the data, χ^2 = 220.351*(136*), CFI = .963, NNFI = .928, RMSEA = .040. First, we observed that, for both positive and negative memories, the amount of rehearsal mediated the effect of EC on PC such that although direct links from EC to PC were not significant, indirect effects were found to

be significant, even when we controlled for event intensity. When we examined the passage of time for negative memories, the amount of rehearsal mediated the effect of memory age on phenomenology such that the more time passed after an event, the less it was rehearsed, leading it to be remembered with lower magnitudes in phenomenological characteristics.



[a]The link specifies the total effect involved in the mediation between Avoidance and Phenomenological Characteristics.
[b]Mediation between Avoidance and Rehearsal Characteristics was found only for negative memories.
[c]Mediation between Memory Age and Phenomenological Characteristics was found only for negative memories.

Figure 2. Mediation patterns in the autobiographical memory model as a function of attachment styles

Although memory age and causal links between EC, RC, and PC were similar across groups, it was observed that the influence of attachment styles differed depending on the valence. For negative memories, EC mediated the effect of avoidance not only on PC, but also on MC, revealing that avoidance resulted in less personal significance attributed to negative memories, which further resulted in decreased ratings for both rehearsal and phenomenology[3]. With respect

to attachment anxiety, higher levels of anxiety resulted in increased levels of meaning attributed to the event and higher frequency of rehearsal as well as higher ratings in phenomenological characteristics. When we controlled for the compound effects of EC on MC, it appeared that the link between anxiety and PC was mediated by MC, indicating that negative memories were remembered better as they tended to be rehearsed more frequently.

On the other hand, for positive memories, as attachment avoidance increased, individuals attributed less meaning to the event, or reported low levels of emotion at the time of the event, which mediated the effect of avoidance on phenomenology. Different from negative memories, EC only mediated the link between avoidance and phenomenology, not frequency of rehearsal. In contrast to avoidance, anxiety was found to exert a similar influence on positive memories except that attachment anxiety was not linked to EC for positive memories. This finding indicated that individuals with high attachment anxiety did not attribute personal significance to positive experiences despite frequent rehearsal. On the other hand, for these individuals, frequent rehearsal of positive events enhanced their recollection. Estimates for the direct and indirect effects for positive and negative memories were presented in Table 5.

Table 5. *Direct and Indirect Effects of the Structural Model with Attachment Variables*

	Negative Memories			Positive Memories		
		95% Cl			95% Cl	
	Estimates	Lower Bound (BC)	Upper Bound (BC)	Estimates	Lower Bound (BC)	Upper Bound (BC)
Direct Effects						
Avoidance →EC	-.192^{+}	-.354	-.003	-.370**	-.537	-.211
Avoidance → MC	-.094	-.224	.050	.029	-.094	.176
Avoidance → PC	.029	-.118	.160	-.094	-.232	.050
Anxiety →EC	.193*	.009	.365	.173	-.003	.346
Anxiety → MC	.224**	.079	.361	.153*	.024	.263
Anxiety → PC	.102	-.027	.264	.098	-.025	.250
Event Intensity → PC	.387**	.242	.518	.391**	.078	.546
EC→ PC	.115	-.224	.421	.026	-.405	.429
MC→ PC	.445**	.186	.719	.425*	.206	.764
Memory Age → MC	-.147*	-.267	-.037	-.117	-.242	.006
Memory Age → PC	-.054	-.163	.070	-.072	-.215	.071
Indirect Effects						
Avoidance → MC	-.137*	-.251	-.008	-.296**	-.438	-.165
Avoidance → PC	-.161*	-.275	.-.040	-.205**	-.333	-.098
Anxiety → MC	.138*	.005	.265	.138*	.001	.281
Anxiety → PC	.219**	.105	.349	.166**	.061	.288
EC→ PC	.506**	.480	.675	.561**	.233	.914
Memory Age → PC	-.066*	-.146	-.017	-.050	-.141	.000

* p <.05, ** p < .01, $^{+}$ p = .050

Discussion

In the current study, we aimed to identify the higher-order constructs of autobiographical memory and characterize attachment-related variation on distinct memory components. We emphasized an integrative framework attempting to explain the systematic links between distinct mechanisms underlying autobiographical remembering. In doing so, we first characterized latent constructs to distinguish memory processes corresponding to event-, rehearsal- and retrieval-related features. In the next step, we tested how attachment anxiety and attachment avoidance interacted with each memory process in determining how individuals remember their relationships. Overall, attachment-related goals were reflected on the latent constructs of remembering, but the pattern of the relationships between memory processes and these goals differed for positive and negative memories. In the following sections, we first summarize the conceptual model proposed here, and then we discuss attachment-related variation in qualitative features and how it was manifested on the overall pattern of autobiographical remembering.

Towards a model of autobiographical remembering

In previous research, the common tradition has been to examine memory phenomenology with unique items (Johnson et al., 1988; D'Argembeau et al., 2003; Talarico et al., 2003; Bertnsen & Rubin, 2006) with well-established scales. Evidence so far has indicated that particular items tend to correlate regardless of the type of memory (Rubin et al., 2003 Johnson et al., 1988; Sutin & Robins, 2007) pointing out a common denominator. However, there has not been a consensus on classification of autobiographical memory constructs.

Fitzgerald and Broadbent (2013) considered a theory-driven approach to be more reliable in testing distinct memory constructs and the structural relations among them. They proposed a latent constructs model suggesting that the impact of the event is directly related to the frequency of rehearsal and to metacognitive and affective features of remembering. We reiterated the need

to characterize the higher-order constructs in order to understand the structural relations involved in remembering and argued that encoding, rehearsal, and retrieval, all have their own dynamics both conceptually and temporally. Event-related characteristics (EC) constitute the encoding-related features that represent the event itself. Although subjective ratings might be provided at the time of the retrieval, the event has been already constructed to a large extent, therefore event characteristics refer to a distinct time period than the retrieval. Rehearsal characteristics (RC), on the other hand, correspond to the time between encoding and retrieval, and refer to the frequency of reliving the experience in different forms. As previous evidence suggested, EC are involved in the way that an event is rehearsed such that emotionally more intense, more important, and more consequential events tend to be remembered more frequently, which enable the maintenance of the memory (Walker et al., 2009). Event characteristics, thus, provided the phenomenological baseline for subsequent retrieval (Wilson & Ross, 2003; Walker et al. 2009). Phenomenology of remembering constitutes the sensory or affective elements at the time of the recall. In that sense, it is reasonable to argue that personal significance of an experience (Bluck & Levine, 1998) and the strength of encoding or reconsolidation were related to the retrieval quality (Berntsen & Rubin, 2006; Bernsten & Bohn, 2009) along with the factors that are unique to retrieval (e.g. cognitive load or contextual factors) (Williams et al., 2007).

The model proposed by Fitzgerald and Broadbent (2013) was similar to the one that we currently propose but there are also notable differences. First, we did not include metacognitive elements into a model of remembering since belief about the occurrence and accuracy of an experience involve a subjective judgment that is likely to be supported by diverse sources of information in addition to the extent of detail in memory representation. Reflection on past experiences and metamemory processes contribute to beliefs about memory. In addition, psychological distance from the event (Bluck & Demiray, 2011), as well as the individual

characteristics such as trait dissociation (Merckelbach, & Muris, 2001) or experiential avoidance (Cribb, Moulds, & Cartermay, 2006) may modulate memory-related beliefs. On the other hand, we focused on the phenomenology of component processes (Rubin, 2006), that is, the memory experience at the time of the remembering. These processes may contribute to the beliefs regarding a memory as well but we suggest that belief does not constitute an integral part of the memory.

A second distinction from the work of Fitzgerald and Broadbent (2013) was that we included involuntary remembering as a feature of rehearsal. Since involuntary memories involve event-specific knowledge rich in sensory-perceptual detail (Berntsen, 2009), they enhance recollective experience. Rasmussen and Berntsen (2009b) argued that, different from voluntarily recalled memories, involuntary memories have directive function such that detailed, picture-like event representations in these memories provide clear guidelines for the individual whereas voluntary forms of rehearsal, being regulated by the individuals' current goals, are more open to memory reconstruction. Therefore, we argue for the talking, voluntary and involuntary forms of rehearsal that each has unique functions and emerges in relation to different situational demands. Therefore, being such a significant feature of memory, involuntary remembering was included as a determinant of the rehearsal component. Last, two models differ with respect to how they linked emotional intensity and memory phenomenology. More specifically, current model, proposed event intensity as a factor of Event Characteristics (EC), however, the way it operates is rather different than the remaining features in the same domain. Emotional intensity at the time of experience varies the amount of information that is initially encoded. On the other hand, subjective evaluations of the event are being made after the event has already occurred. Although, emotional intensity is very much related to the personal meaning attached to the event, it has unique contribution in predicting recollection (Talarico et al, 2003; Ford et al., 2008), and

therefore, in the current model, event intensity was directly linked to the phenomenology at the time of the retrieval.

As valence-related differences in memory processes have been documented in previous studies (D'Argembeau et al., 2003; Rasmussen & Berntsen, 2013), we tested the validity of the model for positive and negative memories, which ensured the measurement and structural invariance across memories. As expected, independent of memory valence, emotional intensity, as well as, the personal significance of an event in general resulted in more frequent rehearsal and the amount of rehearsal was positively related to the recollective features at retrieval. However, for negative memories, only emotional intensity, rather than the personal significance per se, predicted the PC. This indicated that, as in the tunnel memory phenomenon (Berntsen, 2002), for negative memories, the effect of emotional intensity is so salient at the time of the encoding that it dominates other features of the event in predicting the memory experience. On the other hand, for positive memories, subjective meaning of the event significantly predicted the phenomenology at retrieval even when controlling for the emotional intensity of the event such that the more emotionally intense, important, consequential, or self-defining an event was, the higher it was rated for vividness, sensory imagery, or emotionality at retrieval. Such valence effects are meaningful from a functional perspective in the sense that positive memories may serve to boost one's sense of self and to preserve social bonds, resulting the subjective value of memory to be maintained over time to remind favorable experiences (Rasmussen & Berntsen, 2009a; Harris et al., 2013). On the other hand, the salience of event intensity could be explained with attempts to disregard the value of negative events over time in order to preserve self-esteem or to regulate negative affect (Alea & Bluck, 2003).

Overall, the proposed model characterized the links between the latent constructs specific to autobiographical remembering. We further argued that depending on the unique individual

goals, particular functions of event-, rehearsal-, or phenomenological-characteristics might be altered. Considering each latent factor representing a distinct memory mechanism in the model, next, attachment linked changes in these mechanism are discussed along with further implications of the model.

Attachment-Linked Variation in Latent Constructs of Remembering

We specifically examined the attachment-linked variation in memories of romantic relationships. As previous research demonstrated, hyperactivating strategies associated with attachment anxiety act as a threat alarm leading to persistent activation of relationship-related fears (see Mikulincer & Shaver, 2007, for extensive evidence). Therefore, we expected high levels of attachment anxiety to be associated with qualitatively rich memories, especially for the negative ones. On the other hand, deactivating strategies, associated with avoidance, operate emotion regulation mechanisms early on and set *protective* boundaries in a way to eliminate the impact of relational experiences (Shaver & Mikulincer, 2007). Accordingly, avoidance was expected to be associated with poor memory qualities in general. However, we expected the direct impact of avoidance to be manifested only on event characteristics, which further mediated the avoidance related changes in rehearsal and phenomenology.

Attachment anxiety and preoccupation with relational memories. It was expected for attachment anxiety to persistently activate the relational schema that biased information processing negatively. In general, high anxiety was associated with more emotional intensity, subjective value attributed to the event, more rehearsal, especially more memory pop-ups, and more intense remembering for both positive and negative memories. However, it is noteworthy that, for positive memories, anxiety was not linked to EC. As also documented by previous research, the reason for this may be that information processing of anxiously attached individuals tended to be biased by negative, but not positive, stimuli (Mikulincer et al., 2004; Edelstein,

2006). Therefore, high attachment anxiety may prevent processing of positive relational information which would otherwise modify the existing schema. Actually, since negative memories involve more schema-consistent information, they are easily integrated with existing negative relational schemas, however, positive experiences create discrepancies for the self-memory system (Conway et al.,2004). Therefore, whereas these individuals tend to relate negative experiences to their self easily, they are less likely to do so for the positive experiences (Conway et al., 2004).

In addition, rehearsal (RC) mediated the link between anxiety and phenomenology (PC). High attachment anxiety predicted more frequent rehearsal that actually strengthened the memory representation, leading to better retrieval. It is noteworthy that the mediation pattern applied to positive memories as well. The frequency of rehearsal linked with anxiety indicates the extent to which the individual is preoccupied with the relational experiences. For negative experiences, this 'preoccupation' may reflect attempts to protect the self, keeping the individual in a vigilant state for relational threats. It is also possible that individuals may talk about their relational problems, and try to seek support from others to ease anxiety. On the other hand, for positive memories, frequent remembering may serve various functions such as reconciling the positive experiences with the existing negative schemas (Bluck et al., 2010) or preserving social bonds (Alea & Bluck, 2003).

Each rehearsal involves not only reconsolidation but also reconstruction processes, then one might question why highly anxious individuals did not update their schemas despite frequent rehearsal and rich recollection of positive experiences. Previous evidence indicated that individuals with high levels of attachment anxiety are prone to memory errors (Pereg & Mikulincer, 2004; Fraley et al., 2000). Therefore, for these individuals, it is likely that positive information is integrated in a way consistent with the dominant attachment schema, resulting in

integration of false information (Simpson, Rholes,& Winterheld, 2010; Mikulincer & Shaver, 2005).

Attachment avoidance and distancing from relational memories. Regarding attachment avoidance, we argued for a pre-regulatory mechanism. In other words, we expected attachment avoidance to directly influence only event characteristics (EC), however, indirect effects were to be examined for potential mediating effects. We found that avoidance correlated any of the negative memory characteristics whereas for positive memories, high avoidance was associated with lower ratings for all indicators of EC (except self-definition) and PC (except auditory imagery). However, with including the estimates for the indirect effects, the model revealed the broader pattern on which avoidance operates. As we expected, for both memory types, avoidance was directly linked only to EC, indicating that individuals with high attachment avoidance tended to disregard the emotional intensity and significance of relational experiences, even the positive ones, which further leads to less frequent rehearsal of these experiences. This supported previous evidence that highly avoidant individuals tend to process relational information in accordance with a fight-slight schema (Ein-Dor et al., 2011). In other words, these individuals take precautions for foreseen negativity, even in positive experiences, which serves the function of attenuating the impact of intimacy-related events (Edelstein & Gillath, 2008; Fraley & Shaver, 2007).

It was not only the EC that were altered, but also, albeit indirectly, avoidance resulted in poorer memory rehearsal and phenomenology of remembering. First, for both negative and positive memories, EC mediated the link between avoidance and PC, indicating that, recollective experience gets poorer to the extent that highly avoidant individuals succeed to decrease the subjective value of the experience. Therefore, highly avoidant individuals initially blocked the level of experience, both cognitively and affectively, at the time of the encoding, and

consequently, less important, less consequential and less affective memories were recollected with less emotional intensity and sensory imagery, as it occurs in the retrieval of any autobiographical memory (Talarico et al., 2004; D'Argembeau et al., 2003).

In a similar vein, EC mediated the effect of avoidance on RC for positive memories, but not for negative memories. It appeared that once these individuals with high avoidance attenuate the personal significance of an experience, they do not think or talk about the experience, which leaves no space for further elaboration, even for reconsolidation of a positive experience. This finding was striking when we consider the potential functions of remembering positive memories, in that, for avoidant individuals it is less likely to integrate positive experiences and use them as corrective feedback in their relationships (Bluck & Habermas, 2000; Bluck et al., 2010).

Overall, it appeared that avoidance biased information processing against positive information and therefore these individuals tended to keep relational experiences distant and recalled their memories in a less detailed, less emotional manner. Although consistent evidence was documented in previous research (Fraley et al., 2000; Kohn et al., 2012; Edelstein, 2006), underlying mechanisms of poor retrieval had not been specified. Here, we argued that devaluing positive experiences may serve self-consistency and avoidance from the expected relational threats.

Implications for the Model

Current findings revealed that self-regulation strategies associated with anxiety and avoidance were manifested on autobiographical remembering in distinct patterns. Attachment anxiety intensified the memory experience via rehearsal. Avoidance on the other hand, acted more on encoding, or the event-specific features, and initial biases in perception modified subsequent rehearsal and recollection. It appeared that memory processes are modulated in a way that reflects the underlying regulatory goals of associated with anxiety and avoidance.

These findings are important to understand attachment-related changes in the broader aspects of memory experience other than the valence or the content. Since we worked on memories of romantic relationships, the role of attachment representations as a major determinant of relationship dynamics was emphasized. However, relationship memories are no different than any other autobiographical memory, therefore the model could be applied to test memory processes in general, which further allows to examine other theoretically relevant individual-specific factors. As studied in previous research, individual differences in trait-rumination (Thomsen, Schnieber, & Olesen, 2011), emotion regulation (John & Gross, 2007; Richards & Gross, 2003), and depressive symptomology (Williams et al., 2007; Kuyken & Brewin, 1995) may lead to specific changes in how memories are encoded, rehearsed or retrieved.

Overall, current model expanded our understanding regarding the mechanisms that characterize autobiographical remembering. Although there have been extensive research investigating the individual differences in autobiographical remembering, only few of them demonstrated the specific routes on which individual difference are reflected upon (Tinti et al., 2014). Considering a broad framework for autobiographical memory, we first underlined the higher-order constructs. In general, event characteristics influence the way memories are rehearsed such that personally meaningful events tend to be rehearsed more often. Also, it is evident that the memory experience at the time of the retrieval depends on both the factors associated with the event and the nature of rehearsal in between encoding and rehearsal. Although the way memory processes are linked may have slight variation depending on the memory type (i.e. positive and negative memories), current model provides a general structure for us to study autobiographical remembering, which could be well applied to any type of event or in integration with any domain of individual differences. In that sense, such an integrative approach

complements the general model for autobiographical remembering in consideration with who remembers.

CHAPTER II

Remembering Successes and Failures: Rehearsal Characteristics Influence Recollection and Distancing

Abstract

We investigated how components of ruminative cognitive processing, brooding and reflection influence autobiographical remembering. We specifically tested whether rehearsal patterns (i.e. voluntary and involuntary) mediated rumination-related changes in the sensory-affective (i.e. recollection) and metacognitive (i.e. psychological distance) features of the memory experience. We focused on achievement and failure memories as both are goal-related events, yet they represent distinct experiences in terms of valence and functionality. For failure memories, brooding resulted in intense recollection and reduced the psychological distance. Brooding enhanced the distance of achievements, indicating the disruptive effects of brooding on remembering.Although reflection attenuated the recollective experience for both achievement and failure memories, it brought achievement memories to a subjective closer past. Structural equational modelling demonstrated the mediating role of involuntary remembering on the pattern of experience of remembering.

Keywords: Autobiographical Memory, Rumination, Goal Memories, Voluntary Rehearsal, Involuntary Rehearsal

Remembering Successes and Failures: Rehearsal Characteristics Influence Recollection and Distancing

Autobiographical memory research has focused mostly on the accuracy and the qualitative features of remembering, but in the last twenty years, there as been substantial interest in the motivational processes underlying why we remember our past. When the adaptive significance of remembering is emphasized, examining the individual-specific variation becomes relevant and necessary. In this paper, we argue that past events are remembered in the way they are because they serve a particular function in that context. However, what is functional may vary across individuals and that variation is reflected on memory experiences accordingly. We also argue that, individuals rehearse past events for particular purposes and the way rehearsal modulates the memory experience at recall may differ depending on both the form of rehearsal (i.e., voluntary vs. involuntary) and individual characteristics of the rememberer. Focusing on the two constructs of rumination, reflection and brooding, we aimed to understand whether the individual tendencies to reflect and brood differentially influence the nature of rehearsal, which may mediate their influence on the cognitive and affective features of remembering.

Rumination

Rumination has been conceptualized as self-focused repetitive thoughts, associated with a compulsive focus on negative experiences (Nolen-Hoeksema & Morrow, 1991; Martin & Tesser, 1996). Even though they think about them frequently, highly ruminating individuals tend to rehearse events at an abstract level, which reduces the specificity (Watkins, 2008; Williams et al., 2007) and degree of emotional reliving at the time of recall. This abstraction is functional in that, as ruminating individual tend to think mostly about negative events, rehearsal does not enhance emotional processing but rather operates to attenuate the emotional impact of negative memories. Therefore, although each rehearsal serves emotion regulation in the short-run, rumination

prevents adaptive integration and closure in the long run, particularly for negative memories (Ayduk & Kross, 2010).

In addition to reduced specificity in recall, individuals with ruminative tendencies are likely to recall memories with poor imagery (Watson, 2015; Thomsen, Schnieber, & Olesen, 2011). Because they do not attempt to retrieve affective-perceptual details in the time between encoding and retrieval, rehearsal is less likely to contribute to the strength of specific information associated with the event. However, especially for intense negative experiences, lack of emotional processing is associated with frequent, vivid, and highly emotional involuntary recall (Brewin, Gregory, Lipton & Burgess, 2010; Berntsen, 2009). In other words, because rumination leads to extensive recall of selective information, the event and its details continue to be accessible and that accessibility increases the frequency of involuntary remembering. These findings lead to the contradictory conclusions that rumination may both suppress and enhance memory experience during recall. We argue that the two components of rumination, brooding and reflection, may differentially account for the variation in the way rumination influences memory processes.

The concept of rumination reflects the tendency to engage in self-focused repetitive thinking but the form or the purpose of this repetitive thinking may vary according to the components of rumination (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Watkins & Taesdale, 2004). One component, reflection, is the exploration of past experiences to relate them to current goals. In that sense, the cognitive processes associated with the reflective capacity serve self-regulation as well as self-continuity over time (Ayduk, & Kross, 2010). The other component, brooding, increases one's focus on negative events and tends to trigger an abstract level of processing (Thomsen, 2006). This form of thinking is less flexible and it revolves around more schematic and overgeneral information (Williams et al., 2007). Thus, both forms of

rumination increase the amount of rehearsal but it is likely that they utilize different cognitive processes, reflecting differentially on the memory experience at the time of recall.

Along with the differentiation in rumination, we also focused on the qualitative aspects of memory experience, specifically on the phenomenology of recollection and psychological distance. The former component reflects the episodicity of remembering by which sensory-affective features serve the reliving of the event memory (Fitzgerald & Broadbridge, 2013; Öner & Gülgöz, 2016). The latter, psychological distance, indicates the subjective feeling regarding the remoteness of the event. It reflects more of a metacognitive judgment (Van Boven, Kane, McGraw, & Dalei 2010) about the recollective experience. In the next section, we examine each construct and review the evidence about the ways rehearsal is involved in modulating memory experience.

Recollection: The Affective-Sensory Component of Memory

Phenomenology of recollection refers to the degree a past experience is relived at the time of recall. The past can be re-played in the present to the extent individuals can retrieve sensory details to generate a vivid imagery of the event (Rubin, 2005; Rubin, Schrauf, & Greenberg, 2003). Along with sensory details, emotional reliving keeps the individual in the event as at the time of encoding, and this internal experience further enhances re-experiencing.

As emotionality and self-relevance make autobiographical recollections richer, the valence of the event modifies several characteristics of recollection (Rubin & Umanath, 2015). In general, positive memories include more contextual detail (Levine & Piazzo, 2004) and are recalled with more vividness and emotional intensity compared to negative ones (Talarico, Lebar, & Rubin, 2004; Bohn & Berntsen, 2007; D'Argembeau, Comblain, & van den Linden, 2003; Rasmussen & Berntsen, 2009). Although they are not as vivid as positive memories, negative

memories include more specific details of the event (Berntsen & Rubin, 2002) and these details tend to be more accurate compared to positive ones (Levine & Pizarro, 2004).

Such differences in vividness of positive and negative memories can be explained from a functional perspective (Rasmussen & Berntsen, 2009). Through autobiographical remembering, individuals look back to their past in a way to ensure continuity of 'who they are' over time (Habermas & Bluck, 2000;McAdams, 2003) . Enriched representations of positive events help individuals to develop and maintain a positive self-image (Bluck et al., 2005). When there is a threat to self, remembering a positive event would be especially useful to counteract the negative emotional state and enable emotion regulation (Pasupathi, 2006; Rusting & Dehart, 2000). The richness of the contextual details is adaptive as well. Each cue represents an association that will trigger retrieval processes, which further increases the accessibility for these memories. As for negative memories, directive function appears to be more pertinent (Pillemer, 2003; Rasmussen & Berntsen, 2009). Recalling what did not work in the past guides subsequent behaviors for improved effectiveness. For that reason, specific details associated with negative events have critical informative value (Berntsen, 2009).

Just as the valence of the event influence the phenomenology of recollection, rehearsal processes are influential as well. In voluntary remembering, the event representation is reactivated and the information in the event memory is reconciled with the individual's current state (Walker, Skowronski, Gibbons, Vogl, & Ritchie, 2009). This requires some details to be strengthened while some others fade. When an event is rehearsed to resolve past issues or for its directive value, only the relevant details are to be retained. For some events, rehearsal serves to increase the salience of the general theme (i.e. feeling proud) rather than the details, as it is the general theme that supplies the functional value of the recall (Pillemer, Ivcevic, Gooze, & Collins, 2007).

Psychological Distance: A Meta-Cognitive Feature of Memory

In the context of autobiographical memories, psychological distance is conceptualized as how far the individual feels from the event, independently of the objective passage of time (Ross & Wilson, 2002). It is a principal indicator of the availability of the event memory in one's mental representation. As the personal goals and self-descriptions associated with an event are no longer relevant or valued by the individual, it is more likely that the memory of that event would become less salient, or distanced from the self (van Boven et al., 2010). Such distancing is even more likely and functional for negative experiences as it allows the individual to attribute past failures to a distant self, a self that does not represent the current individual (Sutin & Robins, 2008). On the contrary, events that serve self-enhancement such as past accomplishments tend to be perceived as psychologically close even after much time has passed (D'Argembeau, & Van der Linden, 2008).

Individuals' ability to change the subjective distance of an event is an adaptive mechanism (Sutin & Robins, 2008; Wilson, Gunn, & Ross, 2009). Distancing negative or self-discrepant experiences and keeping the positive events near may help an individual to maintain a positive sense of self and a coherent identity (McAdams, 2003; Wang & Ross, 2007). In addition, momentarily distancing from negative memories enables the individual to evaluate a situation more objectively, which further supports emotion regulation and protects the individual from getting too immersed in the negative affect (Katzir & Eyal, 2013 Ayduk & Kross, 2010; Kross & Ayduk, 2008).

Rehearsal is an important mechanism that influences the individual's estimation of psychological distance. When individuals were asked to think about negative experiences in a constructive, self-affirmative manner, distancing was reduced, leading them to perceive these events as psychologically closer than before (Ross & Wilson, 2002). On the other hand, rehearsed

events showed less affective fading (Walker et al., 2009) and were perceived as more remote (Demiray & Janssen, 2014). This may be a function of the way events are rehearsed rather than merely the frequency of rehearsal. Studies indicate that describing an event in affective and vivid terms brings a memory psychologically closer (van Boven & Ashworth, 2007) whereas retelling events in an abstract, evaluative manner increases the psychological distance and, especially for negative experiences, attenuates the emotional intensity over time (Habermas & Berger, 2011).

Besides the frequency of rehearsal, psychological distance may be affected by the type of rehearsal. For example, involuntary remembering drives events psychologically closer and serves to increase the salience of memory representation, demanding more effort to elaborate on events (Berntsen, 2009). Voluntary thinking and talking about past experiences, on the other hand, tend to be more elaborative, and they form reliving episodes. Thus, voluntary recall may contribute to self-enhancement (Demiray & Janssen, 2014; Bluck & Alea, 2007)), resolution of interpersonal conflicts (Alea & Bluck, 2007), and emotion regulation (Pasupathi, 2006).

We also consider psychological distancing as an important cognitive strategy for emotion regulation, instrumental in enhancing and reducing the influence of the event memory. The closer the events are kept, the more accessible they will be compared to subjectively distant events and their accessibility will further facilitate the utilization of these memories for their specific functions. Thus, even if the recollective details of an event are not easily available, the representation of the event itself may be subjectively close.

Present Study

The present study aimed to characterize the mechanisms by which rehearsal of positive and negative events influence the memory experience at the time of recall. As we expected a large variation in the rehearsal patterns of different forms of positive and negative memories (Rasmussen & Berntsen, 2009; D'Argembeau et al., 2003), we chose a specific group of

memories, memories of goal achievement and failure. Our hypothesis was that failure memories would be reported with negative affect such as frustration and sadness whereas positive emotionality would be more salient in achievement memories. Therefore we requested goal-related events and investigated the differences by manipulating the outcome of the goal as either a failed or achieved one. As goal-related events would be meaningful for identity formation, their voluntary (thinking and talking) and involuntary rehearsal would be substantially functional, and that would be reflected on the memory experience. Therefore, using goal-related memories would allow us to go beyond examining valence-specific (negative *vs*. positive) memory characteristics and focus on more specific interactions between self and autobiographical remembering.

We included in this study measures for brooding and reflection, which constitute two distinct yet related forms of rumination. We expected both variables to be associated with rehearsal, but we also expected each to modulate the memory experience in unique ways. We examined several components of memory experience in this study. Recollective features such as vividness and emotionality characterized the affective-sensory features of remembering whereas psychological distance represented the metacognitive attribute for temporality (or mental time travel). We argued that, even though an event is richly recollected and emotionally intense, an avoidance mechanism might keep the event at a distance as a way of emotion regulation, particularly for failure memories. A similar but reverse mechanism could be true for achievement memories such that an event may not be remembered with much detail but, it may still be perceived psychologically closer as a function of self-enhancement.

Method

Participants

We recruited a total of 259 undergraduate students (151 female) with a mean age of 21.89 (*SD* = 1.43). Participants were told that they would be reporting their memories associated with

their major goals in their lives. On the basis of the first letter of their first name, they were assigned to either goal-blocked (*N* = 149, 97 female)) or goal-achieved (*N* = 110, 64 female) conditions. This procedure has been used in previous studies and ensured random group assignment across participants (Demiray, Gülgöz, & Bluck, 2009).

Measures

Autobiographical Memory Questionnaire (AMQ). The questionnaire used in this study was derived from those used in earlier studies (Rubin, Schrauf, Gülgöz, & Naka, 2007; Rubin et al., 2003) with the addition of a question about psychological distance. After reporting goal-related events, participants indicated the psychological distance of the event *("How far away does the event feel?"*) using a continuous slider with values ranging from 0 to 100. The numeric values were not visible to the participant, however, they provided their ratings on a continuum lying in between "I feel like the event happened today" to "I feel like the event occurred very long time ago" (Demiray & Janssen, 2014; Liberman, Sagristano & Trope, 2002). Then, they provided the actual date of the event for the reported memory. In the final step, the participants rated memories on 7-point Likert scales in response to the given statements associated with the qualitative features of the memory such as emotional intensity (then, now), importance (personal significance of the event), consequentiality (the extent that the event has consequences), voluntary (frequency of thinking and talking), and involuntary rehearsal (frequency of memory pop-ups), remember-know (sense of remembering vs. knowing at recall), reliving (the extent of re-experiencing at recall), and sensory imagery (auditory and visual imagery). Participants also indicated the emotional influence of the memory with a valence item rated from 1 (*very negative*) to 7 (*very positive*).

Ruminative Response Scale (RRS). Treynor, Gonzalez and Nolen-Noeksema (2003) re-analyzed the 22 items in the Rumination Scale (Nolen-Hoeksema & Morrow, 1991) and proposed

RRS as an alternative measure of rumination that is free of items related to depression. The 10-item RRS included two subscales targeting the dynamics associated with adaptive versus maladaptive forms of ruminative cognitive processing. Five items measure the extent of individuals' reflection on their experiences to create meaning or to take lessons (e.g. *I analyze recent events to try to understand why I am depressed; I go someplace alone to think about my feelings*). The remaining five items (e.g. *I think 'What am I doing to deserve this?'; I think 'Why can't I handle things better?'*) measure brooding, which represents the maladaptive form of rumination in which individuals rehearse negative aspects of their experiences and inflate the intensity of the existing negative emotions. Participants indicated how much they engaged in specified forms of thinking, on a 4-point Likert scale, from 1 (*almost never*) to 4 (*almost always*). Two-factor structure of RRS was confirmed by a study on the Turkish form of the scale (Erdur-Baker & Bugay, 2012).

Procedure

Participants were taken to the laboratory in groups of 4-6 and they completed the survey online on individual computers. After answering the questions about their age and gender, participants provided a memory associated with an important goal they pursued. Goal-related events differed across groups in terms of the outcome of the event, that is, whether they achieved the goal or not. The instructions were identical for both groups except for the event outcome (underlined sections to the failure group and sections in parentheses to the achievement group):

> "*In this step, we want you to report a personal memory about an important goal that you really wanted <u>but could not achieve</u> (and you could achieve). The goal could be related to anything but it should be an important goal that you <u>failed</u> (achieved). Please try to be as specific as possible. You may proceed when you are ready*."

After reporting goal-related memories, participants first indicated the psychological distance and dated the event. In the next step, they provided phenomenological ratings for the event on AMQ. Finally, the participants answered the RRS items.

All parts of the study were administered through a widely used online survey program (Qualtrics, 2013). Completion of the study took approximately 30-45 minutes and participants were compensated by course credit. Before the participants left the experiment room, they were given a written form of debriefing.

Results

We expected that the way achievement- and failure-related memories were represented in memory had different recollective properties and distinct functions, providing individuals unique information about significant experiences in the past. For that purpose, we first tested the phenomenological differences and then investigated the correlations between these features in achievement and failure memories. Then, we conducted mediational analyses using structural equation modeling in order to test the role of individual differences in reminiscing functions, on the psychological distance, as well as the recollection of goal-related events. Our target variables included the memory characteristics as well as the psychological distance.

Means and standard deviations of target variables are presented in Table 1. Multivariate analysis of variance was conducted with memory type as the independent variable and the memory characteristics as the dependent variables. The multivariate effect was significant for the memory type, Pillai's Trace = .56, $F(14, 244) = 17.87$, $p = .00$, $\eta p^2 = .549$, indicating a difference in the phenomenological properties of achievement and failure memories. Further univariate analysis demonstrated that, as we expected, valence ratings for achievement and failure memories were significantly different, $F(1, 259) = 257.39$, $MSE = 456.25$, $p = .001$, $\eta p^2 = .502$. Along with this, significant group differences were found for self-definition, $F(1, 259) = 10.17$, $MSE = 32.60$,

p = .002, ηp^2 = .038, current intensity, $F(1, 259) = 12.90$, $MSE = 31.33$, p = .001, ηp^2 = .048, and imagery, $F(1, 259) = 5.36$, $MSE = 12.39$, p = .021, ηp^2 = .022. Achievement memories were perceived as more self-defining (M = 4.83, SD = 1.70) compared to failure memories (M = 4.10, SD = 1.85). Similarly, achievement-related memories included more recollective features such that they were remembered with more imagery (M = 4.64, SD = 1.34) and emotional intensity (M = 4.33, SD = 1.53) than failure memories (M = 4.20, SD = 1.64; M = 3.63, SD = 1.63, respectively).

Table 1. Means and standard deviations of variables for achievement and failure events

	Failures (N = 149)	Achievements (N = 110)
Distance	49.53 *(33.58)*	44.21 *(30.35)*
Event Intensity	5.64 *(1.39)*	5.83 *(1.34)*
Current Intensity**	3.63 *(1.64)*	4.33 *(1.54)*
Reliving	5.27 *(1.50)*	5.58 *(1.60)*
Imagery*	4.20 *(1.64)*	4.64 *(1.35)*
Remember-Know	5.46 *(1.48)*	5.59 *(1.48)*
Involuntary	3.91 *(1.76)*	4.25 *(1.53)*
Voluntary	4.03 *(1.38)*	4.26 *(1.12)*
Importance	5.63 *(1.50)*	5.98 *(1.44)*
Reality	5.77 *(1.61)*	5.81 *(1.59)*
Consequentiality	5.06 *(1.63)*	5.16 *(1.59)*
Self-Definition**	4.12 *(1.85)*	4.83 *(1.70)*
Valence**	1.62 *(1.20)*	4.30 *(1.49)*
Brooding	11.96 *(3.09)*	12.20 *(3.22)*
Reflection	12.05 *(3.08)*	12.57 *(2.96)*
Memory Age[1]	47.40 *(37.68)*	51.00 *(38.40)*

[1]Memory age represents the number of months since the event.

When we included memory age (i.e. the duration between the event and the recollection) as a covariate, the differences reported above were maintained. In addition, significant covariate effects of memory age were found on involuntary, $F(1, 259) = 5.21$, $MSE = 14.26$, $p = .023$, $\eta p^2 = .020$, and voluntary rehearsal (i.e. thinking and talking about the event), $F(1, 259) = 9.08$, $MSE = 14.33$, $p = .003$, $\eta p^2 = .034$.

Tables 2 and 3 display the correlation coefficients for failure and achievement memories, respectively. Inter-correlations among the target variables demonstrated that failure-related events were perceived psychologically closer with the increase in event significance and in the intensity of recollective features of the memory. On the other hand, for achievement memories, psychological distance was not related to event significance or recollective features. For achievement memories, the only variable that showed a significant relationship was rehearsal in the form of talking about the event. As individuals talked more about achievement related events, they perceived events psychologically closer. We also tested whether the correlation between psychological distance and phenomenological features were significantly different for achievement and failure memories. Using a two-tailed test of significance ($\alpha = .05$), we found that the correlations of psychological distance with current intensity ($z = 3.01$). visual imagery ($z = 3.51$), involuntary thinking ($z = 2.35$), and importance ($z = 2.28$) were higher for failure memories than achievement memories.

Table 2. Correlation Coefficients for Failure Memories

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Distance	1	.18*	.04	-.28**	-.23**	.04	-.20*	-.38**	-.31**	-.28**	-.24**	.01	.02	.06	-.02	.03
2. Memory Age		1	-.02	-.16	-.17*	.02	-.19*	-.22**	-.13	-.21**	-.11	-.04	.02	.26**	-.13	-.06
3. Event Intensity			1	.17*	.22**	.30**	.23**	.03	.31**	.10	.27**	.17*	.21**	-.18*	-.07	-.07
4. Current Intensity				1	.62**	.28**	.29**	.50**	.37**	.27**	.14	.14	.13	-.21*	.27**	.12
5. Imagery					1	.61**	.44**	.47**	.40**	.40**	.24**	.16	.23**	-.11	.26**	.09
6. Reliving						1	.46**	.21*	.23**	.14	.14	.06	.08	-.05	.08	-.01
7. Remember-Know							1	.36**	.35**	.28**	.17*	.14	.08	-.07	.09	-.04
8. Involuntary								1	.36**	.58**	.25**	.14	.17*	-.18*	.20*	.14
9. Importance									1	.41**	.21**	.22**	.28**	-.15	.17*	.16
10. Voluntary										1	.22**	.26**	.28**	-.07	.17*	.09
11. Reality											1	.22**	.13	-.11	-.04	-.04
12. Consequentiality												1	.44**	.02	-.03	.04
13. Self-Definition													1	-.02	-.02	-.03
14. Valence														1	-.09	-.15
15. Brooding															1	.48**
16. Reflection																1

*$p < .05$, **$p < .01$

Table 3. Correlation Coefficients for Achievement Memories

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Distance	1	.03	-.01	.00	.00	-.05	-.15	-.07	.11	-.16	-.17	.16	.04	-.07	.07	-.15
2. Memory Age		1	.02	.01	-.04	.09	.08	-.03	.03	-.15	.13	-.17	-.04	.02	.03	.02
3. Event Intensity			1	.22*	.15	.02	-.10	.03	.09	.06	.03	.02	5	-.07	.14	-.06
4. Current Intensity				1	.52**	.31**	.24*	.34**	.08	.18	.07	-.06	.09	.07	.06	-.06
5. Imagery					1	.47**	.30**	.30	.07	.21*	.02	-.03	.06	.20*	-.02	-.03
6. Reliving						1	.47**	.24*	.05	.11	.11	.14	.12	.04	.04	.08
7. Remember-Know							1	.16	.03	-.02	.35**	-.08	-.06	.04	.03	.08
8. Involuntary								1	.04	.56**	-.02	-.11	.08	.02	.04	-.10
9. Importance									1	.12	.26**	.16	.24*	.06	.08	.02
10. Voluntary										1	-.05	.02	.23*	.11	-.03	-.08
11. Reality											1	-.05	-.03	.03	.02	-.03
12. Consequentiality												1	.58**	.04	.16	.10
13. Self-Definition													1	.02	.04	.13
14. Valence														1	-.13	-.05
15. Brooding															1	.27**
16. Reflection																1

*$p < .05$, **$p < .01$

Structural Model Predicting Cognitive and Affective-Perceptual Modes of Remembering

Goodness of fit for the model was evaluated using likelihood ratio of chi-square (χ^2, nonsignificant) with degrees of freedom (χ^2/ d*f* < 3). However, since these values are very sensitive to sample size and model complexity, incremental fit indices (comparative fit index, CFI); normed fit index, NFI) were reported to determine the model fit relative to alternative models. We also used root mean square error of approximation (RMSEA) as an indication of model parsimony. We considered the model appropriate when CFI and NFI were greater than .90 (Hu & Bentler, 1995) and RMSEA was smaller than .80 (Kleine, 2005). Nested models were compared to establish measurement invariance across achievement and failure memories and for the comparison of nested models, in addition to the significance of the difference, we evaluated relative changes in all absolute and incremental fit-indices.

Measurement Invariance across memory types. As we observed item-based (i.e. current intensity, imagery) differences across memory types, we had to test whether the latent factor of recollection corresponds to the same construct for both achievement and failure memories. For this reason, we first conducted several multi-group confirmatory factor analyses to establish measurement invariance[4]. In each step, the model was tested with gradually more constraints (van de Schoot, Lugtig, & Hox, 2012). First, we tested for the configural invariance (M1, Table 4) in which all parameters were allowed to differ across groups, which ensured the same conceptual definition of the construct for both groups. Then, we tested for the metric invariance (M2, Table 4) to see whether all factors were represented similarly in determining recollection of achievement and failure memories. This was followed by constraining only the intercepts (M3, Table 4). Last, we tested the scalar invariant model (M4, Table 4) in which both loadings and intercepts were kept invariant. We did not constrain more parameters to establish residual invariance because scalar invariance has been considered sufficient to reliably compare

groups regarding the latent construct, and additionally, keeping residual variances free allowed us to examine determinants of the construct other than the specified items (van de Schoot et al., 2012).

The latent construct for recollection was indicated with three items which were current intensity, reliving and imagery. Pattern invariant model resulted in adequate fit, χ^2 (2) = 4.193, CFI = .998, NFI = .978, RMSEA = .065, p = .123, confirming that all factor loadings were significant for the intended latent construct. Compared to the pattern invariant model, factorial (metric) invariance did not significant chi-square difference value, $\Delta\chi^2$ = .249 with 2 *df*, p = .883. In the second step where only intercepts were kept invariant, the changes were not significant either, $\Delta\chi^2(2)$= .915, p = .633. Scalar invariance was established by keeping both loadings and intercepts invariant and compared to the default model, the change was not significant in this model, $\Delta\chi^2(4)$ = 7.205, p = .125. Model fit indices also supported measurement equivalence of scalar invariant model compared to default model χ^2 /*df* = 1.900, CFI = .973, NFI = .945, RMSEA = .059.

Table 4. Model Fit Indices for Confirmatory Factor Analyses, Measurement Invariance and Structural Model

		Model Fit Indices							
	Models	χ^2	χ^2/df	P	CFI	NFI	RMSEA	AIC	BCC
Invariance Models	M1.Configural	4.193*(2)*	2.096	.123	.989	.980	.065	36.193	37.247
	M2. Metric	4.442*(4)*	1.111	.349	.998	.978	.021	32.442	33.364
	M3. Intercept	5.108 (*4)*	1.277	.276	.994	.975	.033	33.108	34.030
	M4.Scalar	11.397*(6)*	1.900	.077	.973	.945	.059	35.397	36.188
Nested Model Comparison	M1 vs. M2	0.249*(2)*	.412	.883					
	M1. vs. M3	7.205*(4)*	.125	.125					
Structural Model	M5. Structural Model	42.162*(34)*	1.240	.159	.983	.925	.031	190.162	203.030

SEM for testing the mediational role of rehearsal.

We investigated the role of rehearsal on the way ruminative tendencies influence phenomenology of recollection and psychological distance (see Figure 1) using structural equation modelling (SEM). Multi-group SEM tested the mediation model with AMOS 21.0 software. Involuntary and voluntary rehearsal were separated as each may have their own specific functions, but, for voluntary rehearsal, we used the average score of highly correlating *think* and *talk* items in AMQ, both of which reflects the extent of intended recall.

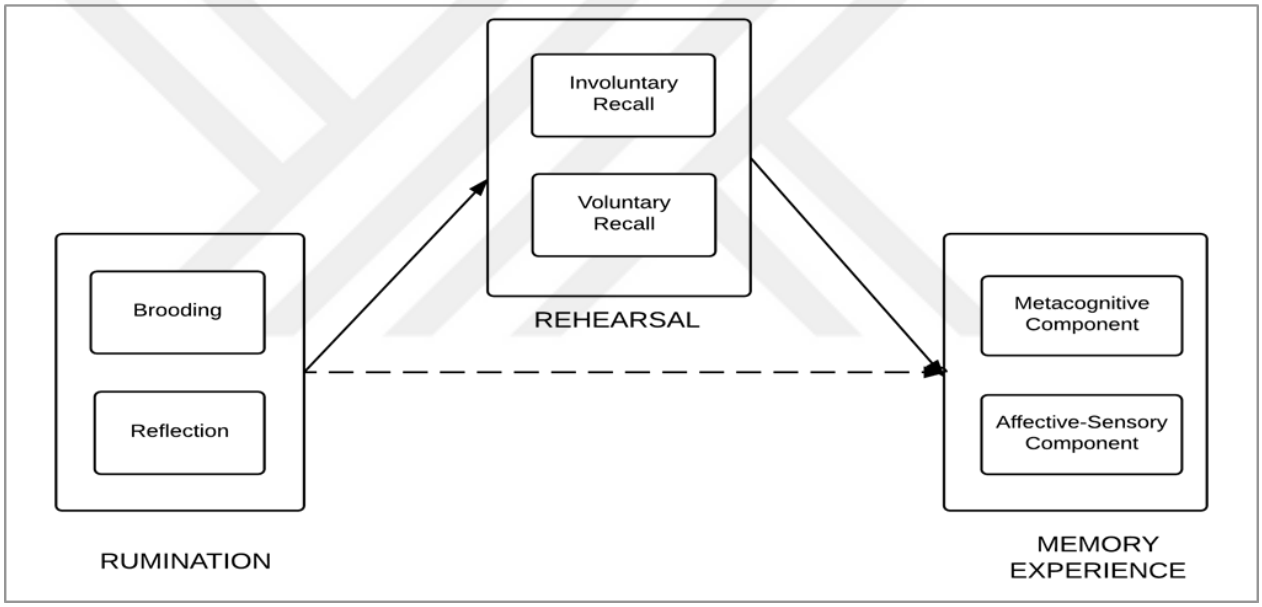


Figure 1. Variables tested in the mediation model

Direct and indirect effects in the mediation model were tested with Bootstrapping which basically involves resampling of the data multiple times with replacement and provides estimations for the sampling distribution of indirect effects (Shrout & Bolger, 2002). With Bootstrapping, full model is tested simultaneously and generates more accurate confidence intervals (Hayes, 2009), for this reason, it has been considered superior than the more conventional method of regression series (Baron & Kenny, 1986). We requested 1000 bootstrap

samples and conducted percentile-based bootstrap with 95% bias-corrected confidence intervals. Estimates and upper and lower limits for the direct and indirect effects are presented in Table 5.

The overall fit of the model (see Figure 2 for failure memories, Figure 3 for achievement memories) was found to be very good, $\chi^2 = 42.162(34) = 1.240$, CFI = .98.30, NFI = .925, RMSEA = .031 (M5 in Table 4). First, we observed that, the effect of memory age differed across memory types, which was likely to result from the valence differences. As time passed by, we found fading of affect and distancing for failure memories, however, qualitative features of achievement memories were unaffected by passage of time.

For failure memories, we found that brooding individuals tended to experience frequent involuntary memory pop-ups for failure related events, which resulted in these memories to be richly recollected and to be perceived psychologically closer. Although involuntary remembering mediated the effect of brooding on distancing, for the phenomenology of recollection, we found only a partial mediation. Brooding, by itself, appeared to result in better recall of failure memories and this effect was further enhanced by involuntary remembering. We also found that reflection reduced the recollection of failures and this effect was independent of any forms of rehearsal.

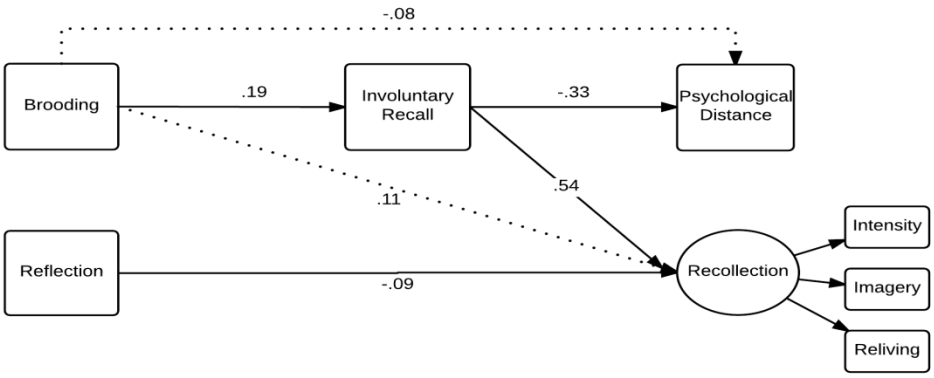


Figure 2. Significant links in the model for failure memories. Dotted lines represent indirect effects.

On the other hand, for achievement memories, involuntary remembering mediated the effect of reflection on recollection. The more individuals reflected upon achievements, the less they experienced memory-pop ups, resulting in achievements to be poorly recollected. We also found that ruminative tendencies had distinct and opposing effects on psychological distance. More specifically, brooding resulted in achievements to be perceived as remote events whereas reflection brought them psychologically closer. Finally, for both achievement and failure memories, voluntary rehearsal reduced psychological distance, such that thinking and talking about such events made them more salient, leading individuals to perceive them as closer events and this effect was independent of the form of rumination.

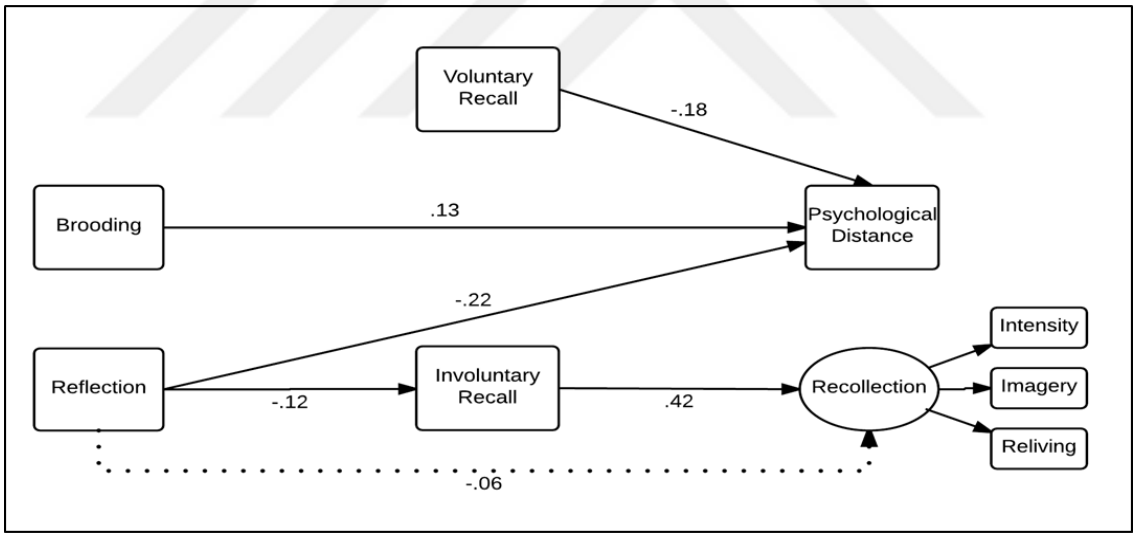


Figure 3. Significant links in the model for achievement memories. Dotted lines represent indirect effects.

Table 5. Standardized Coefficients for the Direct and Indirect Effects in the Mediation Model for Achievement and Failure Memories

	Failure Memories			Achievement Memories		
		95% Cl			95% Cl	
	Estimates	Lower Bound (BC)	Upper Bound (BC)	Estimates	Lower Bound (BC)	Upper Bound (BC)
Direct Effects						
Brooding → Recollection	.203**	.132	.275	.094	-.005	.184
Brooding → Distance	.052	-.011	.115	.133*	.047	.205
Brooding →Voluntary	.176**	.110	.254	-.002	-.087	.086
Brooding → Involuntary	.190**	.104	.276	.079	-.022	.161
Reflection →Recollection	-.086+	-.156	-.018	.042	-.032	.130
Reflection → Distance	.046	-.018	.110	-.222**	-.295	-.149
Reflection → Voluntary	-.020	-.100	.063	-.080	-.174	.025
Reflection → Involuntary	.028	-.056	.111	-.119*	-.221	-.016
Voluntary→Recollection	.012	-.074	.112	.127	.012	.224
Voluntary →Distance	-.078	-.149	-.004	-.176**	-.282	-.082
Involuntary→Recollection	.541**	.457	.628	.417**	.306	.544
Involuntary →Distance	-.331**	-.407	-.245	.000	-.095	.089
Memory Age →Recollection	-.101*	-.160	-.042	.049	-.038	.129
Memory Age → Distance	.107*	.043	.166	.003	-.069	.072
Indirect Effects	.					
Brooding → Recollection	.105**	.055	.154	.033	-.013	.077
Brooding → Distance	-.077**	-.115	-.045	.000	-.017	-.019
Reflection → Recollection	.015	-.031	.060	-.060+	-.121	.-.010
Reflection → Distance	-.008	-.400	.024	.014	-.004	.037

*$p < .05$, **$p < .01$

Discussion

The purpose of the current study was to understand how different forms of rehearsal influenced the experience of remembering positive and negative events, specifically, the memory for achievement and failure memories. We investigated the role of ruminative tendencies of the individual as it relates to voluntary and involuntary rehearsal. We distinguished between two independent types of rumination, brooding and reflection and identified how differential tendencies influenced retrieval characteristics including reliving, imagery, emotional intensity as well as psychological distance which we considered to be indicative of emotion regulation.

Our results showed that achievement memories were rated as more positive and more self-defining than failure memories. The experience of retrieval of achievement memories also contained higher imagery and higher emotional intensity. These findings suggested for a tendency for reduced availability for failure memories. Although failures may have a directive function for future actions (Rasmussen & Berntsen, 2009), there is more value in remembering the derived lesson or the moral of the story than reliving the event with all the emotions and imagery. Therefore, an attenuated abstraction of the event is a better representation as it protects the self while keeping the functional elements (Kross & Ayduk, 2008). This interpretation is supported by the correlational analyses showing that whereas no such a relationship is observed in achievement memories, as time passes over the event, failure memories are less remembered (more known) and they became more positive. On the other hand, as achievement memories are functional for self-enhancement (Demiray & Janssen, 2014; Pillemer et al., 2007), the time since the occurrence of the event has no impact on any of the phenomenological qualities of the memory. For example, although psychological distance of failure memories increases with time, no such effect is observed in achievement memories.

Psychological distance is conceived as an indication of emotion regulation (van Boven et al., 2010; Ross & Wilson, 2002) and it does not correlate with any of the measures for achievement memories. In general, achievements are perceived closer and remain independent of passage of time or any event characteristic. The fate of failure memories is quite different. Failure memories display significantly different levels of association between psychological distance and emotional intensity, imagery, importance and involuntary thinking. As psychological distance increases, there is a decrease in all these measures. In a similar vein, one of the components of rumination, brooding, correlates with the recollective qualities of failure memories, but not of the achievement memories. Such results present a basis to approach achievement and failure memories, not only functionally but also qualitatively distinct. For that reason, we chose to analyze the relationships between rumination, rehearsal, and the memory experience as separate structural models.

In the structural equation modelling analyses for failure memories, we observed that a tendency for brooding is associated with smaller psychological distance and higher recollective properties like emotional intensity, imagery, and reliving. In addition, a tendency to reflect is associated with lower recollective properties. The model for achievement memories is considerably different. Brooding reflects a tendency to think negatively or in a pessimistic manner and this increase in the psychological distance of achievement memories may serve the function of discounting achievements. This is congruent to the finding that brooding tendency is associated with high involuntary recall, which is associated with smaller psychological distance of failure memories. The analysis on achievement memories also showed that tendency to reflect is associated with reduction in psychological distance and with lower levels of involuntary thinking, which in turn, is associated with lower recollective properties.

The pattern of findings is important in relation to the functions of ruminative tendencies. Current findings supported the disruptive effects of brooding to be functional for the individual's unique goals. More specifically, brooding-related changes in remembering failures and achievements may serve self-continuity as brooding is associated with a negative self-view (Thomsen, 2006; Watkins & Taesdale, 2004). Failure-related events may be perceived as self-congruent experiences that need to be retained with vivid information. For that reason, failure memories are represented psychologically closer to maintain easy access. However, this may also reflect the inability to effectively regulate emotions associated with failure events. Inflexible and repetitive thinking in brooding may drain executive resources to adaptively process and integrate past failures to one's self, which then, prevents the closure and abstraction of the event in the memory system (Watkins, 2015). For achievements, brooding has a similar function but the influence is reflected in distinct ways to the memory experience. As for the failure events, the negative focus in brooding may lead achievements to be perceived as self-incongruent, that is, they are perceived as events which occurred in the remote past, detached from the current self. But still, this serves continuity, as self-enhancing effects of the positive information cannot be integrated to self because of the reduced salience of achievements.

On the other hand, it is evident that the capacity for reflection has an adaptive role in remembering. As reflective cognitive processing involves stepping back from the original experience (Kross & Ayduk, 2008; Sutin & Robins, 2008), it has substantial role in the abstraction of the event, transforming the specific memory experience to a conceptual representation. This is highly functional as recollective features of the memory are eliminated over time, especially for negative experiences like failures. However, for achievements, although the memories are not very vivid, achievements are perceived as they occurred in the near future,

pointing out the salience of achievements in the memory system. This suggests that individuals with high reflective capacity retain the lessons like what has or has not worked in the past, but 'forget' specific details. This way of abstraction facilitates transformation of the event representation to a more conceptual level, which is particularly useful for the integration and closure of failure events. In addition, when remembering achievements, reflection also serves self-enhancement, as these events are perceived psychologically closer.

Overall, the basic conclusion from the present study is threefold. First, differences in the pattern of relationships across achievement and failure memories indicated that although both are associated with past goals, memories of achievement and failure events have distinct qualities. Beyond differences in valence, they have differential organizational value for how individuals utilize remembering for self-regulation. Second, individual differences in ruminative tendencies are associated with the rehearsal mechanisms. Ruminative tendencies of brooding and reflection result in distinct processing patterns and they regulate the memory experience accordingly. Brooding disrupts the adaptive functioning of autobiographical remembering with keeping failures as psychologically close, vivid episodes, and achievements as events of the distant past. For reflection, the influence is reversed such that failure events fade over time whereas achievements are perceived more salient. Despite the differences in their influence on the memory phenomenology, brooding and reflection utilize autobiographical remembering functionally in line with the goals of the individual. Finally, the role of rehearsal mechanisms was distinguished, in that, involuntary, but not voluntary, recall interacts with the ruminative tendencies and organizes their influence on the memory experience differentially for achievement and failure memories. This supports the idea that, individual differences in autobiographical

memory functions are reflected in unique ways to the way individuals remember past experiences.

CHAPTER III

Autobiographical Remembering Regulates Emotions: A Functional Perspective

Abstract

Emotional deviation has been considered an essential factor in emotion regulation, in that, attempts to compensate for the deviation is reflected on cognitive processes. In the present study, we focused on autobiographical remembering and tested the functional role of memory on the emotion regulation. We specifically examined how recalling emotional events influence individuals' subsequent memory reports. Individuals (N = 153) were randomly assigned to three groups to report either sadness or anger evoking events or neutral events that they experienced in the last five years. Although valence and intensity ratings for the subsequent recall were similar across memory types, sadness and anger induction affected distinct features of the subsequently reported memory. Irrespective of the memory type, the extent individuals were feeling negative or positive after the initial recall, valence of the subsequent recall varied as well. In addition, individual differences in reappraisal moderated the effect of reported memories such that we observed counterregulation mechanisms in individuals with higher reappraisal tendency. Overall, our findings supported for the emotion regulation function of remembering that serves counterregulation of the negative emotion. We discuss potential mechanisms in the light of explanations by a functional approach to autobiographical memory.

Keywords: Aubiographical Memory, Emotion Regulation, Reappraisal, Mood-Incongruence

Autobiographical Remembering Regulates Emotions: A Functional Perspective

Emotions influence the function, as well as the flow of almost all cognitive processes, including autobiographical remembering. Emotions act as internal cues that trigger the retrieval of particular memories (i.e. Buchanan, 2007; Holland & Kensinger, 2010), but autobiographical remembering subsequently transforms the emotional state along with the individual's goals and expectations as well. Despite vast evidence about how and why emotions influence memory processes, studies have emphasized the effect of remembering on the emotional state only very recently. A perspective emphasizing the effect of remembering on the individual's emotional state points out the psychological mechanisms that autobiographical remembering operates on, and these mechanisms may further serve individuals to alleviate the content and intensity of their emotional experiences, even if implicitly. Accordingly, the functional account in autobiographical memory research includes the argument that individuals remember past events in a way that serves self-regulation and self-enhancement.

Although autobiographical remembering and affect regulation are functionally related processes, research in these areas followed distinct pathways so far. More specifically, studies on emotion regulation have utilized memory retrieval as a way of mood induction (e.g. Lench & Levine, 2008; Lerner & Keltner, 2001; Schwager & Rothermund, 2014) but disregarded how variation in the qualitative features of retrieval characteristics, other than valence and intensity, influenced the emotional state. On the other hand, although autobiographical memory studies emphasized the emotion regulation function of remembering (Pasupathi, 2003; Bluck, 2003), there has not been any attempts to test it empirically. Aiming to address this gap in the literature, the present research investigates whether autobiographical remembering serves emotion regulation, and examines the relative contribution of the phenomenological features, such as emotional intensity, reliving, to the regulatory effect of recall. We first review the emotion

regulation function of autobiographical remembering and discuss major points about how it relates to major accounts of emotion regulation.

Emotion Regulation as a Function of Autobiographical Remembering

The functional approach to autobiographical memory (Bluck et al., 2005) emphasized the *why* aspect of remembering rather than performance and accuracy related aspects of *what* and *how*. According to this approach, remembering serves three psychosocial functions, maintaining self-consistency and positive self-view over time (*self* function), developing and maintaining social relationships (*social* function), and reflecting to the past and the future to guide current and future behaviors (*directive* function) (Bluck et al., 2005). In the present research, we focused on a specific aspect of the self-function, emotion regulation, which basically refers to the modulation of memory processes in line with the regulatory goals to manage emotional states (Pasupathi, 2003).

Remembering can be altered in a number of ways, such as by changing what is remembered or the way it is remembered. When individuals are in a negative emotional state, if the regulatory goal is to enhance positive affect, they may selectively recall positive instances that would help achieve that goal (Walker, Skowronski, Gibbons, Vogl, & Ritchie, 2009). For example, after remembering intense negative memories, individuals tend to show attentional biases towards positive information, and they tend to recall more positive memories proceeding to the initial negative memory report (DeWall, Twenge, Koole, Baumeister, Marquez & Reid, 2011; Schwager & Rothermund, 2014) with the aim of reversing negative affect. Despite the canonical idea that emotion regulation goals are hedonic, by which individuals strive to enhance positive affect and reduce negative affect (Tamir, 2009), these goals may be utilized to enhance negative affect as well. Specific memories of negative events intensify the negative emotions and rumination over such events maintains negative affectivity (Thomsen, Schneiber, & Olesen,

2011; Ray, Wilhelm, & Gross, 2008). This form of intense, detailed recall of the past keeps the individuals in a ready state for potential threats. Alternatively, individuals learn from negative past experiences, thus, better recall of specific negative instances are very informative to guide future actions. In that sense, enhancing negative affect with the recall of negative events is considered as a form of self-regulation and, when used adaptively, it is functional for individuals to organize their actions towards desired end-states (Tamir, 2011).

Phenomenological properties of recall are also involved in the implementation of the emotion regulation goals. Recollective features such as reliving, imagery, and emotional intensity (Öner & Gülgöz, 2016; Fitzgerald & Broadbridge, 2013) provide the affective and perceptual details and determine the extent to which remembering influences the current state of the individual. In other words, as an event is recalled with higher imagery and higher intensity, the more individuals are likely to perceive them as if they are re-experiencing the event, which further facilitates the self-regulatory function of remembering. Positive memories contains more detail and are remembered with intense feelings of reliving (Berntsen, 2002; Rubin et al., 2003; D'Argembeau & Van der Linden, 2006; Rasmussen & Berntsen, 2009), therefore, here we argue that when individuals are trying to regulate their emotional states, salient memories of positive events, especially the important, and self-relevant ones, may serve to enhance the positive and/or to reduce the negative affect. Recollective properties moderate the influence of negative memories as well. Individuals may prefer to hold detailed scenes of negative events actively in mind, which helps them to resolve the emotional conflict associated with the event. As in the case of rumination which is also a form of self-regulation strategy (Nolen-Hoeksema et al. 2008), individuals purposefully orient their attention to negative aspects of an event in order to understand and control the negative affect. Despite potential psychological consequences, individuals may prefer to retain vivid memories of negative events that provide specific

information regarding the past at the cost of intense negative affect, so that, they feel less uncertain about future ambiguities. In addition to the recollective properties, metacognitive features of recall play substantial role in the salience of memory representations. Especially psychological distance, which refers to how far the individual feels from the event irrespective of the objective passage of time (Ross & Wilson, 2002), moderates the influence of the event. For that reason, distancing has been considered a mechanism of self-regulation. Perceiving an event as if it occurred in the near past indicates that the event is affectively hot and it is associated with active memory representations. Psychologically closer events, therefore, have considerably more influence on individuals. For example, after remembering psychologically close negative events, regulatory goals aim to attenuate the negative affect evoked by the negative memories. Such a positivity bias was observed only after the recall of psychologically close, but not distant events, lending support to the strength of psychologically close events compared to distant ones (Schwager & Rothermund, 2014). Accordingly, individuals prefer to keep positive memories that boost their self-esteem psychologically closer whereas they try to push negative events to further away. The pattern for positive memories becomes more salient for the events that are highly important as they serve self-enhancement better (Demiray & Janssen, 2014). Moreover, individuals with high self-esteem (Demiray & Janssen, 2014), and low levels of depression (Janssen, Hearne, Takarangi, 2014) tend to use such distancing mechanisms more adaptively in a way to maintain the salience of positive events in the memory system.

Individuals may also directly act on the psychological distance of the event at the time of recall. Vivid recall of events, as well the emotional intensity at the time of the remembering, brings a memory psychologically closer (van Boven & Ashworth, 2007) whereas retelling events in an abstract, evaluative manner increases the psychological distance and, especially for negative experiences, attenuates the emotional intensity over time (Habermas & Berger, 2011). Degrading

the impact of an event (i.e. importance, self-relevance) and remembering from an observer perspective have also been considered to be forms of distancing. Research on recall pespective demonstrated that, negative past experiences tended to be perceived as personally less relevant and tended to be remembered from the perspective of an observer (Sutin & Robins, 2008; Libby & Eibach, 2011), supporting for the regulatory function of distancing to attenuate negative affect. Both processes involve some level of cognitive change to achieve the appraisal of the reported event (McRae, Ciesielski, & Gross, 2011) and to enable the individual to regulate the disturbing emotions associated with the event. Even momentarily shifting visual perspective to the observer reduces the emotional intensity experienced during remembering (Berntsen & Rubin, 2006), supporting the role of distancing in the regulation of emotion.

Contextualization of Emotion Regulation Processes

Emotion regulation processes refer to any set of strategies that individuals utilize to alter the experience and expression of emotions (Mauss, Cook, & Gross, 2007; Gross, 2015). Attempts to regulate may be explicit (Gross, 2002) or implicit (Koole, 2009; Mauss, Bunge, & Gross, 2007), and the regulatory goal may be to increase or to decrease the emotional intensity (Gross & Thompson, 2007). But either way, emotional responses may be regulated at various levels such as cognitive, behavioral or physiological (Gross & Levenson, 1998).

Emotion-generative process is a process in which emotions come into being and gradually increase in intensity as time unfolds. Attempts to regulate these emotions and their effectiveness vary depending on the time of execution (Gross, 2002). As Gross and colleagues explained (e.g. Gross & Thompson, 2007; Ochnser & Gross, 2005; Opitz, Gross & Urry, 2012), the whole process is initiated by the encounter with a real or imagined stimulus, as the individual attends to it, and then followed by the attachment of a subjective meaning, which further triggers changes in multiple response systems (physiological, behavioral or experiential).

The timing of regulatory processes has been one of the widely discussed factors influencing the efficacy of regulation (Gross & Thompson, 2007; Sheppes & Gross, 2011). Extensive evidence has supported the view that the earlier the regulation is executed, the easier and less demanding it would be for the individual to change the emotions to the desired state (Gross, 2015). Strategies targeting the experience level, such as attentional deployment and cognitive reappraisal have been found to be more effective than the strategies directed towards the expression of emotions (Gross & Levenson, 1997; Richards & Gross, 2000; Goldin, McRae, Ramel, & Gross, 2008; Hofmann, Heering, Sawyer, & Asnaani, 2009). The effectiveness of these strategies has been considered to rely on the time they are implemented, but, it is also associated with the intensity of the emotion that needs to be regulated. As Sheppes and Gross (2011) argued, individuals are able to regulate even very intense emotions if they intervene them from the very beginning. Modulation of attentional processes alters the extent of emotional information to be processed. Whereas strategies limiting attentional resources (i.e. distraction) reduce the incoming information, strategies that increase attentional capture (i.e. rumination) intensifies the emotional experience as a result of enhanced vigilance and over-thinking on the emotion-eliciting cue.

If emotions go uninterrupted to the stage of reappraisal, regulatory attempts involve actively changing the meaning of the emotional experience. Therefore, substantial cognitive effort becomes necessary such that the individual has to scan alternative implications of the stimulus, think about potential affective outcomes associated with the alternative ways of appraisal, and further update the meaning of the experience. Later, through the emotion-generative process, strategies must target emotion expression (i.e. suppression) and individuals must try to limit the end-point emotional processing despite the fact that the emotional tendencies have already been activated. Therefore, emotion regulation at this point is harder and evidence has consistently revealed the side effects of behavioral suppression, such as memory impairments

and emotional rebounds (Brewin, Gregory, Lipton, & Burgess, 2010; Gross & John, 2003; Campbell-Sills, Barlow, Brown, & Hofmann, 2006),

The evidence on the explicit emotion regulation is consistent that individuals who habitually use reappraisal or who are instructed to use reappraisal, when compared with the use of suppression, regulate emotions more effectively. However, there has been limited evidence regarding the strategies that operate at a more implicit level. Implicit regulation research highlighted the fact that it is not possible for individuals to continuously monitor their affective states and therefore most regulatory responses operate automatically without conscious awareness (Koole, 2009). For example, Tamir and colleagues (Tamir, Ford, & Gilliam, 2013) asked individuals what they prefer to listen before an interaction involving confrontation or negotiation. Confrontation group preferred anger-related music whereas the negotiation group preferred a calmer one, pointing out the goal-congruent modulation of affective system. Similarly, Schwager and Rothermund (2014) demonstrated that, after recalling negative memories, individuals tended to attend to positive information in the environment. However, this effect was observed only when retrieved memories were perceived as emotionally 'hot', in other words, psychologically closer. These findings are important in the sense that, first, only memories with intense emotional impact trigger regulatory mechanisms. Second, individuals activate regulatory processes without direct instruction to distract, reappraise, or suppress emotional responses. Finally, it appears that the modified response is not necessarily positive, but rather it is congruent with the individual's goals to attenuate or enhance emotional experience. Such assumptions are also in line with what we have discussed regarding the emotion regulation function of autobiographical remembering. For example, recalling positive events vividly intensifies positive emotions and serves self-enhancement, however, recalling a negative memory may facilitate resolution of the event or provide future guidance. In that sense, what determines

the way regulation functions is the interaction between the individual's habitual regulatory behaviors and goals for emotion regulation in a particular context (Opitz et al., 2012).

Present Research

Emotion regulation mechanisms are activated in response to emotional stimuli that lead to a deviation in the affective system that needs to be balanced. The emotional stimulus may be an actual experience but it can also be a memory representing an emotional experience. Accordingly, a number of studies have utilized autobiographical remembering as a way of mood induction (see Lench et al., 2011, for a review), but they have disregarded how retrieval characteristics, other than valence, may influence the emotional state. On the other hand, although emotion regulation function has been emphasized in autobiographical memory research, no studies have empirically tested whether regulatory goals to modify the emotional state are involved in memory retrieval. Even if autobiographical memories serve emotion regulation, regulatory goals may act indirectly on the emotionality and operate on other memory components (i.e. recollection or distance) to modify affect. These possibilities point to the importance of testing autobiographical memory and emotion regulation within an integrative framework.

In the present research, we have a novel approach in the sense that we use autobiographical recall both as a way of mood induction and as a measure through which we examine the influence of emotionality. We examine how remembering emotional or. neutral memories influence subsequent memory retrieval. We first asked for memories of either sadness related memories, anger-related memories or memories with no particular instruction of emotion. After the participants remembered these events, we asked for an additional memory for which we provided no instructions regarding the characteristics of the memory. Since any instruction to regulate (i.e. reappraise, suppress, or increase/decrease affect) constitutes a more active goal for the individual and may guide attentional resources accordingly, it may hinder the inherent

regulatory function of remembering. Therefore, we presumed that the phenomenology in the spontaneous recall enables us to examine whether individuals naturally use remembering for emotion regulation. We hypothesized that, compared to the group with no specific emotion instruction, individuals in the emotional memory groups would report more positive memories with higher emotional intensity in order to counterbalance the emotional state induced by the previous recollections.

We specified particular emotions of anger and sadness in the recollection of past events because cognitive appraisals triggering specific emotions are associated with distinct motivational tendencies (Levine & Pizarro, 2004; LeBlanc, McConnell, & Monteiro, 2015). In relation to this, we expected to see variation in the phenomenology of the subsequent recall depending on the type of emotion in the initial recall and what kind of effort is emphasized for counterregulation. Within an appraisal-theory framework, anger is activated in response to the perception of an obstacle, either in the present or in the past, and which should be eliminated (Levine & Pizarro, 2004). In that sense, anger is very-goal-directed emotion and as an inherently intense emotion, counterregulation of anger requires more immediate and intense changes in affect. Associated appraisals may guide the subsequent recall accordingly, making them retrieve directive memories for goal-attainment or self-enhancing memories reminding achievements. Therefore, in the present context, we expected to activate more goal-oriented emotional responding after anger-induction, leading to the retrieval of intense memories with more recollective features. On the other hand, in contrast to anger, sadness isa post-goal emotion that triggers meaning-making processes (Kaplan, Van Damme, & Levine, 2012) aiming to modify the priorities of the individual. Therefore, sadness represents a reflective internal state in which individuals tend to evaluate their past experiences to understand the cause and consequences. Accordingly, counterregulation of sadness may be achieved by reappraisal processes by which

individuals either degrade importance of the sadness-eliciting experience and focusing on a more important one. In line with these assumptions, we expected the effect of sadness induction to be reflected on the subjective meaning (e.g. importance) of the subsequently recalled event. Therefore, we expect that retrieval characteristics like reliving and importance would be rated higher in the subsequent recall for the individuals recalling anger- and sadness eliciting events, respectively.

Another focus of the present study was the reappraisal processes. Individuals may reconstruct past events through reappraisal. It is also observed that emotional information fades over time as a function of suppression, changing goals and values, or simply passage of time. For example, individuals tend to recall negative relationship events with lower emotional intensity so that they feel better about their relationships (Alea & Vick, 2010). The lowering of intensity can be considered as a function of emotional distancing as well. Such emotional distancing facilitates elaborative processing of the event as it is no longer as emotionally burdensome, which may lead to the resolution and integration of the event. In that sense, reappraisal may act on the memory representations either through emotional detachment or meaning-making processes in reappraisal. In the present study, we specifically focused on reappraisal to examine individual differences in habitual emotion regulation. In doing so, we have two assumptions; one is that reappraisal utilizes cognitive processes in regulating emotions whereas suppression may act on cognitive, behavioral, physiological mechanisms. The other assumption is that reappraisal-related changes appear earlier on the emotional processing (Gross & John, 2003), by which we are better able to identify the regulatory effects on the autobiographical recall subsequent to the emotion induction. We expect high levels of reappraisal to lead to more effective regulation of emotion. We expect individuals to recall more positive and more intense memories in the subsequent memory recall, particularly in sad and anger memory groups.

Method

Participants

We recruited a total of 177 adults (M_{age} = 39.46, *SD* = 11.88; 116 female) using an online survey system, Amazon Mechanical Turk. We required participants to be residents of the United States and data from any other location was automatically discarded. Majority of the sample identified themselves as White/European American (79.8%) while 4.6% of the sample was Hispanic, 8.6% were African-American and 7% were Asian.

Participants were randomly assigned to one of the three goups: sad memory (*N* = 64), angry memory (*N* = 53), and neutral memory (*N* = 60) groups. Sad and angry memory groups constitute the emotional memory groups in which we asked participants to recall three memories to induce sadness or anger, respectively. The neutral memory group was included as a control and individuals in this group reported three daily events that have no particular significance. We called this group the neutral memory group because they were not instructed with any particular emotion but it is clear that there would be considerable emotions involved in memories recollected by this group as well.

Reliability of the survey was secured by using several strategies. First, we used filler items in the questionnaires (i.e. “click 4 whatever your response is”) as an attention check to prevent random answers. Second, we clearly asked them to complete the survey in one session, also indicated that long breaks identified by the background timer would exclude their data and they would not be compensated. Finally, we only included individuals who had approval rates of 95% or higher on Amazon Mechanical Turk workers, which provided higher-quality data (Mason & Suri, 2011).

Measures

Autobiographical Memory Questionnaire (AMQ). We used the AMQ in order to measure the phenomenological properties of reported events. The memory items that we used in this study were derived from AMQ that has been widely used in the autobiographical memory research (Rubin, Schrauf, Gülgöz, & Naka, 2007; Rubin et al., 2003). After reporting each memory, in both initial and subsequent recall phases, participants rated the events for the selected memory properties that are most relevant to emotionality (i.e. valence, intensity), recollection (reliving, imagery) and centrality of the event (i.e. importance). We also asked for the psychological distance with an item *("How far away does the event feel?"*) and participants indicated the psychological distance of the event on a continuum using a slider with values ranging from 0 ("*I feel like the event happened today*") to 100 ("*I feel like the event occurred very long time ago*") (Demiray & Janssen, 2014; Liberman, Sagristano & Trope, 2002). Then, they provided the actual date of the event for the reported memory.

Manipulation check. We asked individuals how they were feeling after the initial recall phase in order to evaluate the influence of autobiographical remembering on their emotional state. They indicated their responses on a 7-point scale in which lower scores represented the negative affect and higher scores represented positive affect.

Beck Depression Inventory-II. The BDI-II (Beck, Epstein, & Brown, 1988) is a 21-item inventory that assesses the presence and the degree of depression. Each BDI item reflects a specific feature of depression or depressive attitude. The participants responded each item on a four graded choices considering how they felt in the past two weeks.

Emotion Regulation Questionnaire (ERQ). Participants also completed the ERQ (Gross & John, 2003) that measures individual differences in their habitual use of two common emotion regulation strategies, cognitive reappraisal and expressive suppression. Reappraisal subscale (6 items) assesses the extent that individuals attempt to change their interpretation of the emotional

stimulus to regulate their emotions. Suppression subscale (4 items) measures the degree to which individuals prevent emotional expression to control their emotions. ERQ items are rated on a 7-point scale and higher scores indicate frequent use of reappraisal or suppression for emotion regulation.

Procedure

We had Amazon Mechanical Turk workers as the study participants. Individuals who fulfilled the study requirements (as indicated in the Participants section) were automatically directed to the Qualtrics online survey system. First, they responded to demographic information questions such as gender, age, and ethnicity. After completing BDI-II, they were assigned to one of the three memory groups. In the two emotional memory groups, we asked participants to report three events that occurred in the last five years which made them feel sad or angry. The specific instructions were as follows:

*"We want you to think back to three events that made you feel lonely, sad, rejected, or hurt (*and *angry, annoyed or enraged* for the anger memory group) *in the last five years of your life. These three events should be progressively sadder and more unpleasant. We would like you to recall these events in detail, remembering how you felt and what happened. Please make sure these are the events that you still feel emotional as you recall now. Take your time to recall the incidents and provide a brief description of each of them."*

On the other hand, the instruction for the neutral memory group was "*We want you to think back to three events from the last five years of your life. These three events should be everyday events that are not necessarily emotional. We would like you to recall these events in detail, remembering how you felt and what happened."*

After participants reported each event, they rated their memory on the memory characteristics, which were valence, intensity, importance, imagery, and psychological distance

and then they dated the event. Following the initial memory recall phase, we had a manipulation check to ensure that autobiographical remembering induced negative affect. In the subsequent recall phase, we requested one random memory, asking specifically *"to recall any event that came to your mind. It could be related to anything but it should be an important, specific event that you experienced".* For this any memory, participants rated all the items in the AMQ and dated the event as well. As the last phase of the study, they completed the ERQ. At the end of the survey, they were debriefed and compensated with $1.25 for their participation in the survey.

Results

Autobiographical memories inducing negative affect, specifically sadness and anger, and neutral memories were examined in relation to how they influenced the reported characteristics of any random memory (ARM) reported subsequently. First, we conducted a univariate analysis of variance to test whether affect ratings provided after the initial recall (post-report emotionality) as a manipulation check differed across individuals reporting sadness, anger, and neutral memories. The effect of memory type was significant, $F(1, 177) = 34.40$, $MSE = 87.34$, $p < .001$, $\eta p^2 = .283$. Post-hoc analyses using Tukey's HSD revealed that individuals reported more negative affect after reporting sadness ($M = 3.25$, $SD = 1.37$) and anger ($M = 2.87$, $SD = 1.53$) memories compared to neutral ($M = 5.15$, $SD = 1.85$) group, but the levels of negative affect were not different in sadness and anger memory groups.

As a next step, the qualitative features of ARM were examined in relation to the memory type and reappraisal tendency. However, since the specific content of emotion (sadness vs. anger) did not distinguish individuals in terms of how they were feeling after remembering, we repeated the analyses using differences in the subjective ratings for post-recall emotionality as an independent variable. In doing so, we created 3 categories where the individuals who reported

feeling more negative than neutral (scores ranging from 1-3) constituted the negative affect group whereas individuals who reported feeling more positive than neutral (scores ranging from 5-7) were assigned to the positive affect group. The remaining individuals who reported neutral feelings (score of 4) formed the neutral affect group.

In order to examine the influence of reappraisal at different levels of emotionality, we created a categorical variable representing individuals with low, medium, and high reappraisal tendencies. The cut-off points distinguishing the three groups were determined using the scores that correspond to one-half standard deviation above and below the mean reappraisal scores. This allowed us to have groups with similar sample sizes and large enough to make meaningful comparisons.

The effect of reappraisal and memory type on ARM characteristics

We conducted a multivariate analysis of variance to test whether memory type (sad, anger, neutral) influenced the affective properties (valence, intensity, reliving, imagery) as well as the psychological distance of any random memory reported subsequently. The multivariate effect was significant for the memory type, reappraisal, and the interaction between memory type and reappraisal (for memory type, Pillai's Trace = .146, $F(12, 328) = 2.147$, $p = .014$, $\eta p^2 = .08$; for reappraisal, Pillai's Trace = .127, $F(12, 328) = 1.852$, $p = .040$, $\eta p^2 = .063$; for the the interaction, Pillai's Trace = .230, $F(24, 664) = 1.685$, $p = .022$, $\eta p^2 = .057$), indicating a significant difference in the way reappraisal level and emotion type of the memories influenced the phenomenological properties of ARM. Univariate analyses demonstrated that the main effect of memory type was significant on psychological distance, $F(2, 176) = 3.365$, $MSE = 3420.85$, $p = .037$, $\eta p^2 = .039$, importance, $F(2, 176) = 3.440$, $MSE = 9.402$, $p = .034$, $\eta p^2 = .039$, reliving,

$F(2, 176) = 5.359$, $MSE = 11.465$, $p = .006$, $\eta p^2 = .060$, and imagery, $F(2, 176) = 4.396$, $MSE = 6.437$, $p = .014$, $\eta p^2 = .050$. Table 1 presented the means and standard deviations of each variable depending on the memory type and reappraisal level.

Post hoc tests using Tukey's HSD showed that for psychological distance, individuals reported psychologically closer memories after reporting emotional events ($M = 31.31$, $SD = 29.15$, sad-memory group; $M = 31.22$, $SD = 33.10$, anger-memory group) compared to neutral events ($M = 44.12$, $SD = 34.48$). After reporting sadness-related events, individuals recalled events with lower importance ($M = 5.11$, $SD = 1.84$) compared to the individuals in the neutral memory group ($M = 5.98$, $SD = 1.41$), however importance ratings provided after anger memories ($M = 5.60$, $SD = 1.81$) did not differ from the ratings of sad and neutral memory groups. For reliving, sadness- and neutral-memory groups were not different from each other ($M = 5.28$, $SD = 1.58$, sad-memory group; $M = 5.22$, $SD = 1.57$, neutral-memory group) but individuals in the anger-memory group ($M = 6.08$, $SD = 1.17$) provided higher ratings than the two groups. Imagery ratings differed only between anger- and sadness-memory groups such that, individuals reporting anger-related events ($M = 6.09$, $SD = 1.05$) recalled subsequent memories with more imagery compared to ones reporting sadness-related events ($M = 5.42$, $SD = 1.32$).

Table 1. Descriptive Statistics for the Study Variables in Sadness, Anger, and Neutral Memory Groups

	Sadness Memories			Anger Memories			Neutral Memories			Memory Type		
	Low Reappraisal	Medium Reappraisal	High Reappraisal	Low Reappraisal	Medium Reappraisal	High Reappraisal	Low Reappraisal	Medium Reappraisal	High Reappraisal	Sadness	Anger	Neutral
Distance	20.41*(13.96)*	37.46*(33.14)*	27.27*(27.20)*	46.70*(41.30)*	35.90*(29.40)*	19.72*(29.75)*	47.87*(34.38)*	45.64*(34.67)*	38.29*(35.62)*	31.31*(29.15)*	31.22*(33.10)*	44.11*(34.48)*
Valence	3.64*(2.41)*	5.46*(2.27)*	4.80*(2.88)*	3.50*(2.59)*	4.86*(2.43)*	5.77*(2.09)*	4.27*(2.81)*	4,93*(2.37)*	3.76*(2.25)*	4,91*(2.51)*	4.98*(2.43)*	4.43*(2.46)*
Intensity	5,29*(2.01)*	5,74*(1.27)*	6,47*(0.83)*	5.80*(1.69)*	6.10*(1.48)*	6.41*(1.18)*	6,07*(0.79)*	5,32*(1.09)*	5.24*(2.20)*	5,81*(1.42)*	6.17*(1.40)*	5.95*(1.69)*
Importance	4.29*(1.94)*	5.03*(1.88)*	6.07*(1.22)*	5.00*(2.31)*	5.33*(1.98)*	6.14*(1.24)*	6.27*(1.22)*	6.18*(1.09)*	5.41*(1.87)*	5.11*(1.84)*	5.60*(1.81)*	5,98*(1.41)*
Reliving	4.50*(2.10)*	5.51*(1.44)*	5.47*(1.13)*	5.80*(1.48)*	5,86*(1.01)*	6.41*(1.14)*	5.27*(1.75)*	5.25*(1.27)*	5.12*(1.93)*	5.28*(1.58)*	6.08*(1.17)*	5.22*(1.57)*
Imagery	4.78*(1.61)*	5.60*(1.10)*	5.63*(1.41)*	5.90*(1.35)*	5.76*(0.96)*	6.50*(0.87)*	5.57*(1.31)*	5.87*(1.24)*	5.73*(1.28)*	5.42*(1.32)*	6.09*(1.05)*	5,75*(1.26)*

The main effect of reappraisal was significant on memory valence, $F(2, 176) = 3.630$, $MSE = 21.200$, $p = .029$, $\eta p^2 = .041$. Low appraisers ($M = 3.85$, $SD = 2.57$) reported memories with more negative affect than both medium ($M = 5.13$, $SD = 2.33$) and high reappraisers ($M = 4.87$, $SD = 2.48$). The two-way interaction between memory type and reappraisal was significant on the intensity, $F(2, 176) = 5.771$, $MSE = 2.770$, $p = .029$, $\eta p^2 = .062$, and importance, $F(2, 176) = 4.103$, $MSE = 6.987$, $p = .003$, $\eta p^2 = .089$. In order to understand the interaction effect, we conducted simple effect analyses, showing that, only in the high reappraisal group, individuals reporting sadness-related events recalled more intense ($M = 6.47$, $SD = 0.83$) and more important memories ($M = 6.07$, $SD = 1.22$) compared to the ones in the neutral group ($M = 5.24$, $SD = 2.20$, for intensity; $M = 5.41$, $SD = 1.87$, for importance).

The effect of reappraisal and post-report emotionality on ARM characteristics

We repeated the previous analyses using post-report emotionality as a between subjects factor instead of memory type and tested whether individuals' affective states after emotion induction and their reappraisal tendency influenced the ARM characteristics. The multivariate effect was significant for the memory type, reappraisal, and their interaction (for post-report emotionality, Pillai's Trace = .253, $F(12, 328) = 3.960$, $p < .001$, $\eta p^2 = .127$, for the reappraisal level, Pillai's Trace = .138, $F(12, 328) = 2.024$, $p = .022$, $\eta p^2 = .069$, and their interaction, Pillai's Trace = .273, $F(24, 664) = 2.024$, $p = .003$, $\eta p^2 = .068$, indicating a significant difference in the way reappraisal level, as well as, how individuals were feeling after the initial recall influenced the phenomenological properties of ARM. Post report emotionality had a significant main effect on psychological distance, $F(2, 176) = 3.199$, $MSE = 3127.931$, $p = .043$, $\eta p^2 = .037$, and valence, $F(2, 176) = 5.766$, $MSE = 25.125$, $p = .004$, $\eta p^2 = .064$, ratings of ARM. The main effect of post-report emotionality on reliving was also marginally significant, $F(2, 176) = 2.857$, $MSE = 6.223$,

p = .054, ηp^2 = .033. The graph in Figure 1 provides a more visual depiction of the differences in ARM phenomenology across groups.

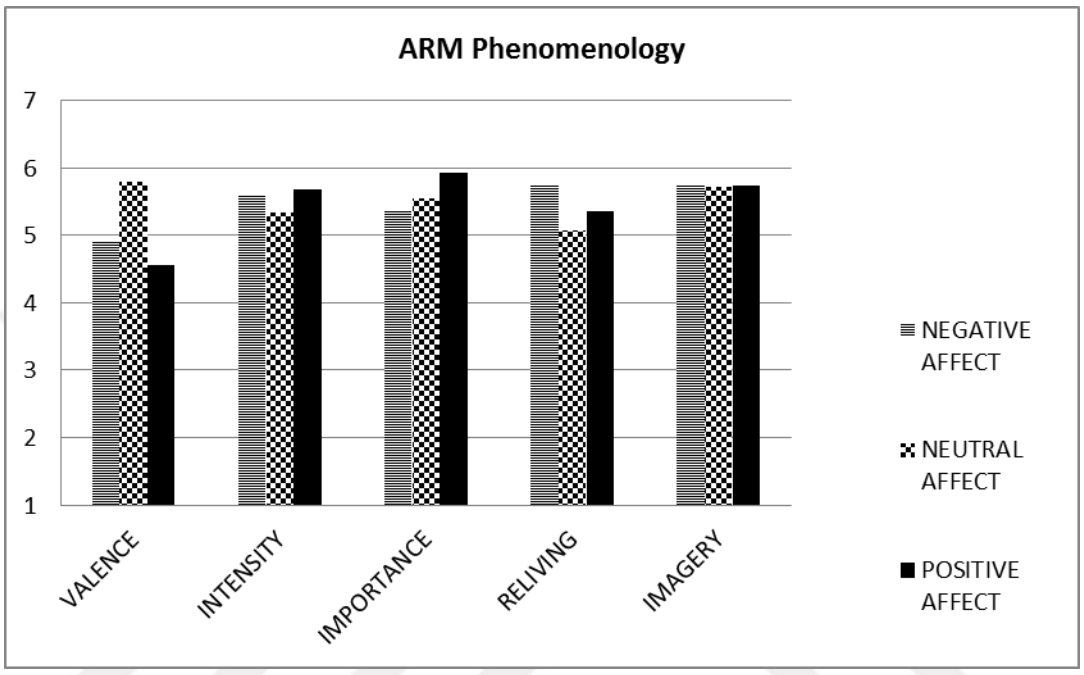


Figure 1. The role of post-report emotionality in the phenomenology of the subsequent recall

Post hoc tests using Tukey's HSD revealed that individuals feeling negative (M = 28.73, SD = 28.89) reported psychologically closer memories than the ones feeling neutral (M = 46.00, SD = 37.99) or positive (M = 38.98, SD = 31.31) (see the right panel in Figure 2). Individuals in the negative affect group (M = 4.69, SD = 2.48) remembered more positive events than the ones in the positive affect group (M = 3.93, SD = 2.51), however, compared to the neutral group (M = 5.77, SD = 2.05), valence ratings of both groups were more negative. For reliving, the difference in the ratings of neutral and negative affect groups differed such that individuals in the negative affect group (M = 5.77, SD = 1.46) reported more reliving than the ones in the neutral affect group (M = 5.09, SD = 1.76), however, positive affect group (M = 5.36, SD = 1.22) was no

different from the negative or neutral affect groups. Descriptive statistics for the study variables were presented in more detail in Table 2.

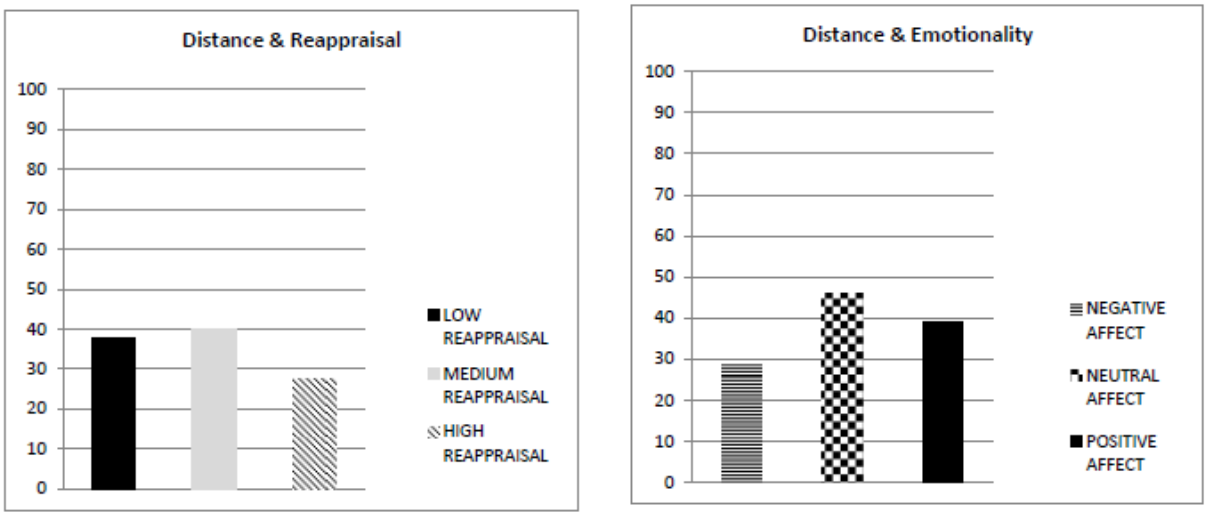


Figure 2. Significant effects of reappraisal and emotionality on psychological distance

Reappraisal had a significant main effect on distance, $F(2, 176) = 3.496$, $MSE = 3417.884$, $p = .033$, $\eta p^2 = .040$, and valence, $F(2, 176) = 4.191$, $MSE = 22.203$, $p = .017$, $\eta p^2 = .048$, as well. High reappraiser individuals ($M = 27.67$, $SD = 31.49$) recalled psychologically closer memories than the ones with low ($M = 37.64$, $SD = 32.88$) and medium ($M = 39.81$, $SD = 32.66$) levels of reappraisal, but the difference between low and medium level reappraisers were not significant (see the left panel in Figure 2). For the main effect on valence, individuals with high ($M = 4.87$, $SD = 2.48$, $p = .52$) and medium levels of reappraisal ($M = 5.13$, $SD = 2.33$) reported more positive memories than the ones with low reappraisal tendency ($M = 3.85$, $SD = 2.57$) whereas high and medium level of reappraisers did not differ from each other.

Table 2. Descriptive Statistics for the Study Variables across Groups of Post-Emotionality

	Negative Affect				Neutral Affect				Positive Affect				Total		
	Low Reappraisal	Medium Reappraisal	High Reappraisal	Total	Low Reappraisal	Medium Reappraisal	High Reappraisal	Total	Low Reappraisal	Medium Reappraisal	High Reappraisal	Total	Low Reappraisal	Medium Reappraisal	High Reappraisal
Distance	29.63*(33.50)*	29.95*(24.52)*	26.44*(32.03)*	28.73*(28.89)*	52.31*(33.05)*	59.11*(39.01)*	18.42*(28.06)*	46.00*(37.99)*	32.14*(24.30)*	40.92*(33.36)*	38.92*(32.23)*	38.98*(31.31)*	37.64*(32.88)*	39.80*(32.66)*	27.67*(31.49)*
Valence	2.89*(2.23)*	5.20*(2.24)*	5.17*(2.49)*	4.69*(2.48)*	6.00*(1.78)*	5.68*(2.28)*	5.57*(2.10)*	5.77*(2.05)*	2.43*(2.29)*	4.60*(4.48)*	3.46*(2.40)*	3.93*(2.51)*	3.85*(2.57)*	5.13*(2.33)*	4.87*(2.48)*
Intensity	5.21*(2.04)*	5.43*(1.39)*	6.14*(1.55)*	5.61*(1.63)*	4.85*(1.73)*	5.32*(1.80)*	5.92*(1.31)*	5.34*(1.67)*	6.43*(0.79)*	5.80*(1.56)*	5.00*(1.68)*	5.67*(1.35)*	5.31*(1.82)*	5.51*(1.43)*	5.81*(1.58)*
Importance	4.58*(2.27)*	5.28*(1.78)*	6.00*(1.34)*	5.36*(1.83)*	5.62*(1.61)*	5.05*(2.07)*	6.25*(1.14)*	5.55*(1.76)*	6.29*(0.95)*	6.16*(1.21)*	5.31*(1.93)*	5.93*(1.45)*	5.23*(1.97)*	5.49*(1.75)*	5.89*(1.48)*
Reliving	5.26*(1.99)*	5.78*(1.07)*	6.10*(1.47)*	5.77*(1.46)*	4.46*(1.85)*	5.42*(1.64)*	5.25*(1.81)*	5.09*(1.76)*	6.00*(1.00)*	5.16*(1.28)*	5.38*(1.19)*	5.36*(1.23)*	5.13*(1.85)*	5.51*(1.29)*	5.74*(1.52)*
Imagery	5.18*(1.78)*	5.80*(0.99)*	6.02*(1.35)*	5.74*(1.33)*	5.35*(1.01)*	5.58*(1.29)*	6.46*(0.75)*	5.75*(1.15)*	5.93*(1.30)*	5.74*(1.18)*	5.62*(1.19)*	5.73*(1.18)*	5.37*(1.47)*	5.73*(1.11)*	6.02*(1.22)*

Interaction between post report emotionality and reappraisal was also significant on importance, $F(2, 176) = 2.746$, $MSE = 7.754$, $p = .030$, $\eta p^2 = .061$, and emotional intensity, $F(2, 176) = 2.550$, $MSE = 6.083$, $p = .017$, $\eta p^2 = .057$. Further simple effects analyses showed that, more negative emotionality after the initial recall resulted in retrieval of memories with more importance and emotional intensity, however, this pattern was observed only for individuals with high reappraisal tendency. For the high reappraiser group, individuals feeling negative ($M = 6.00$, $SD = 1.34$), as well as, neutral ($M = 6.25$, $SD = 1.14$) reported more important memories compared to the ones feeling positive ($M = 5.31$, $SD = 1.93$) after the initial recall. The pattern was similar for emotional intensity, such that, individuals feeling negative ($M = 6.14$, $SD = 1.55$), and neutral ($M = 5.92$, $SD = 1.31$) reported more intense memories than the ones feeling positive ($M = 5.00$, $SD = 1.68$).

Changes in valence in the memories reported in the initial and the subsequent recall

Phenomenology of the any random memories (ARM) reported in the subsequent recall provided substantial evidence regarding how emotion induction influenced autobiographical remembering for individuals with different levels of reappraisal. How individuals were feeling after emotion induction, that is post-report emotionality, influenced the memory valence in the subsequent recall. However, initially recalled memories may create a valence bias for the subsequent recall, therefore, in order to rule out potential confound of emotion-congruent recall (i.e. Rusting, 1999), we also examined whether the valence of the initial memories and ARMs differed across individuals with different levels of emotionality after emotion induction. A two-way mixed analysis of variance was conducted on valence using a) memory groups, the collapsed set of three memories (mean valence of initial memory reports) and the subsequently recalled memory as the within subject factor and, b) post-report emotionality (negative, neutral, positive)

as the between subjects factors. Table 3 presented the descriptive statistics for across levels of each factor. The main effect of pre- and post-valence ratings was significant, $F(1, 174) = 68.638$, $MSE = 255.122$, $p < .001$, $\eta p^2 = .283$, demonstrating that individuals reported more positive memories in the subsequent recall ($M = 5.04$, $SD = 2.16$) compared with the initial recall (M = 3.03, SD = 1.83). The main effect of post-report emotionality was also significant, $F(2, 174) = 15.479$, $MSE = 45.124$, $p < .001$, $\eta p^2 = .151$. Group-wise comparisons revealed that overall valence ratings were significantly lower in the negative affect group ($M = 3.55$, $SD = 1.84$) compared to neutral affect ($M = 4.29$, $SD = 1.63$) and positive affect ($M = 4.73$, $SD = 1.78$) groups, which were not different from each other. More importantly, we found a significant interaction between memory type and pre-post valence ratings, $F(2, 174) = 22.768$, $MSE = 84.627$, $p < .001$, $\eta p^2 = .236$, showing that valence changes were different across memory types. Figure 3 presents the interaction pattern of the valence changes across levels of emotionality.

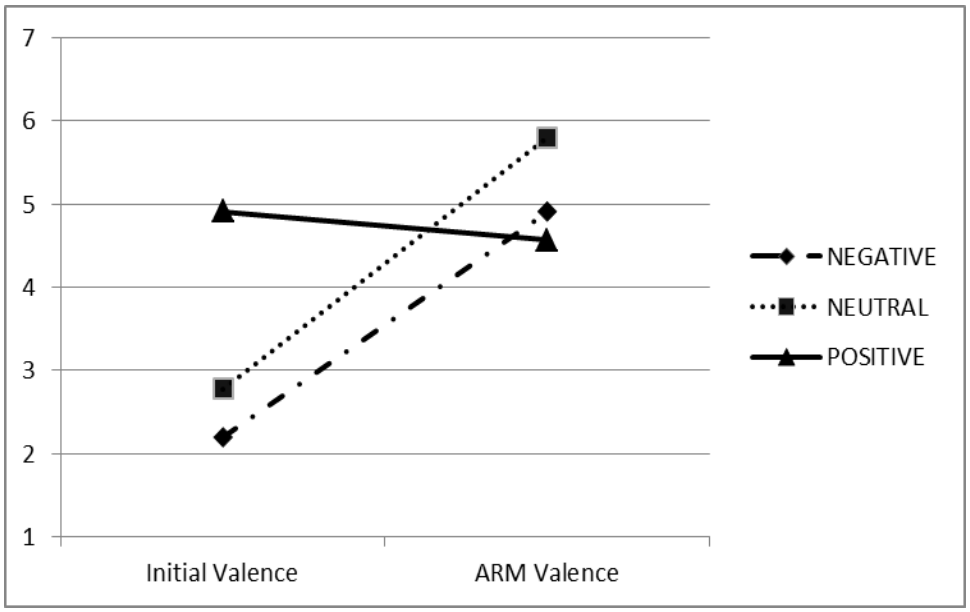


Figure 3. Changes in valence across initially reported memories and ARM

Specifically, compared to the valence of initial memories (for negative, $M = 2.20$, $SD = 1.34$; for neutral affect, $M = 2.78$, $SD = 1.60$), individuals in the emotional memory groups tended to report more positive memories in the subsequent recall (for negative, $M = 4.91$, $SD = 2.35$; for neutral, $M = 5.80$, $SD = 1.65$). However, for the ones in the positive affect group, the difference in the valence of memories reported in the initial ($M = 4.91$, $SD = 1.48$) and subsequent ($M = 4.56$, $SD = 2.08$) recall was not significant

These findings are in line with our expectations, demonstrating not a priming, but an emotion-incongruence effect, in that, individuals who initially remembered negative memories reported more positive events in the subsequent recall. Although increased positivity in the subsequent recall provided supporting evidence for regulatory function of remembering, relationship between valence differences between initial and subsequent recall was further examined at different levels of reappraisal to understand how this regulation function operates depending on the use of reappraisal. We further conducted a three-way mixed analyses of variance, using a) memory groups, the collapsed set of three memories (mean valence of initial memory reports) and the subsequently recalled memory as the within subject factor and, b) post-report emotionality (negative, neutral, positive) and c) reappraisal level (low, medium, high) as the between-subjects factors. The significant main effects of first set compared to subsequent memories, $F(1, 168) = 49.687$, $MSE = 177.495$, $p < .001$, $\eta p^2 = .228$, and post-report emotionality, $F(1.168) = 14.80$, $MSE = 42.357$, $p < .001$, $\eta p^2 = .150$, as well as the interaction between them, $F(2, 168) = 20.700$, $MSE = 73.948$, $p < .001$, $\eta p^2 = .198$, were maintained. Despite null main effects of reappraisal level, we also found a significant interaction between memory groups and reappraisal, $F(2, 168) = 3.194$, $MSE = 11.410$, $p = .044$, $\eta p^2 = .037$. In order to understand the how reappraisal level influenced changes in valence, analyses were repeated for low, medium and high levels of reappraisal. We observed significant main effect for memory

groups only for the individuals with medium and high levels of reappraisal. More specifically, we found significant increases in valence in the subsequent recall, compared to the initial recall, but only for the individuals with medium and high levels of reappraisal (see Table 3). Current findings supported a counterregulation mechanism such that higher efficacy in emotion regulation (i.e. reappraisal) resulted in individuals feeling negative to turn to positivity.

Table 3. Valence Ratings for the Memories Reported in the Initial and Subsequent Recall

		Post Report Emotionality			
	Reappraisal	Negative Affect	Neutral Affect	Positive Affect	Total
Initial Valence	High	2,53*(1,62)*	3,10(1.11)	5,24*(1.44)*	3,21*(1.72)*
	Medium	2,28*(1.39)*	2,26*(1.32)*	4,89*(1.51)*	3,05*(1.84)*
	Low	1,89*(1.02)*	3,28*(2.25)*	4,77*(1.54)*	2,89*(1.90)*
	Total	2,20*(1.34)*	2,79*(1.61)*	4,91*(1.48)*	3,04*(1.83)*
		Negative Affect	Neutral Affect	Positive Affect	Total
ARM Valence	High	2,89*(2.23)*	6,00(1.78)	2,43*(2.30)*	3,85*(2.57)*
	Medium	5,20*(2.24)*	5,68(2.29)	4,60*(2.48)*	5,13*(2.33)*
	Low	5,17*(2.49)*	5,67*(2.10)*	3,46*(2.40)*	4,87*(2.49)*
	Total	4,69*(2.49)*	5,77*(2.06)*	3,93*(2.52)*	4,77*(2.47)*

Configural Relationships across Memory Types

Findings of the mixed ANOVA showed significant increases in the valence in the subsequent recall compared to the initial recall. However, we found group-wise differences in ARM valence only with respect to post-report emotionality, pointing out that the presence of more salient mechanisms blunting the valence-effect in emotional (i.e. sadness and anger) groups . For that reason, bivariate correlations of ARM characteristics with the initial valence and

reappraisal were examined in order to understand the configural relationships across sadness, anger and neutral memory groups.

We found that, for the sad memory group, that high levels of reappraisal was related to increased emotional intensity (r = .331, p = .008) and importance (r = .251, p = .046) attributed to ARM, however, valence of sadness-evoking events were not associated with any phenomenological properties of the ARM. For anger-related memories, on the other hand, the more negative was in the initial recall, more positive events were reported in the subsequent recall (r = -.350, p = .010). In addition, high reappraisal tendency resulted in reporting memories that were psychologically closer (r = -.301, p = .029) and higher in imagery (r = .390, p = .004).(r = .390, p = .004). However, for neutral memories, neither reappraisal nor valence ratings was not related to any phenomenological features of the any memory.

Correlation patterns demonstrated that for sadness-related events, perceived valence had no effect on the subsequent recall. The efficacy of reappraisal, however, resulted in the selective retrieval of more important events. On the other hand, the key emotion is a highly negative and intense emotion in anger memories, therefore, valence of the subsequent recall appeared to be directly affected by the valence of the initial recall. It is also notable that high levels of reappraisal led to the retrieval of psychologically closer and detailed memories, which may be pointing out the supporting mechanisms of counterregulation. Last, null findings for any of the ARM features in the neutral memory group revealed the independence of ARM from the initially recall as there was no attempt for emotion regulation in this group of individuals.

Discussion

In the present study, we were primarily interested in whether autobiographical remembering operates in a way to counterbalance the negative affectivity as a function of emotion regulation. We focused on the regulation of negative emotions, because, in accordance with hedonic motivations, individuals utilize regulatory mechanisms to attenuate negative affectivity. In line with this, we expected that individuals, when they are feeling negative, are more likely to recall positive memories to up-regulate their mood. Phenomenological features, other than valence, may also support the regulatory function of remembering, for that reason, we also investigated changes associated with the emotion induction in the qualities such as importance, emotional intensity, and reliving.

We used autobiographical remembering as a way of mood induction in the first recall phase, in which individuals in the two emotional memory groups recalled sadness- or anger-related events. Neutral memory group, on the other hand, recalled random daily events that were supposed to be non-emotional. Congruent with the emotionality in the initial memory reports, individuals in the emotional memory groups reported to feel more negative compared to the ones in the neutral group. However, the specific type of emotion, sadness or anger, did not lead to any difference in the affect ratings, for that reason, we built our analyses not only on the memory type but also on the post report emotionality.

Memory type did not have any influence on the affective features such as valence or intensity of the subsequent recall, however, differences in recollective features, as well as psychological distance, were notable. After negative mood induction, individuals recalled psychologically closer memories, in other words, the memories that were more salient and active in their memory system. Considering psychological distance as an indication of ease of accessibility, differences in psychological distance may be explained as a mechanism facilitating

up-regulation of positive affect. More specifically, since individuals are motivated to recall positive events after recalling the negative ones, they selectively retrieve the positive events that have more influence compared to the psychologically more distant ones in the memory representations. Because the events that individuals keep psychologically closer tend to be more self-relevant, they may function better in up-regulating their mood by providing readily accessible self-enhancing information. It is also possible that such differences in psychological distance may reflect efforts to regulate emotions such that the more individuals consume cognitive resources for emotion regulation, the less resources are left to retrieve specific memories, resulting in remembering events that are more available. This latter explanation is quite speculative as we have no measure of executive function. However, when individual differences in reappraisal were included in the analyses, differences in distancing disappeared. For that reason, we still consider it reasonable to argue that attempts to utilize positive reappraisal guided individuals to recall memories which are not necessarily highly positive at a level that would result in a significant difference across memory types, but, memories which are influential for self-enhancement, nevertheless.

The type of memory recalled in the first phase led to a difference in recollective features like imagery and reliving as well, particularly between sadness- and anger memory groups. Anger induction, compared to sadness induction, resulted in remembering memories with more reliving and imagery. This is not surprising in the sense that anger is inherently a highly intense, approach-oriented emotion whereas sadness is a low-intensity emotion associated higher durability. Therefore, regulating anger may require more resources that are immediately available such as perceptual details, which leads individuals to selectively retrieve memories with high imagery. Such an explanation is also in line with an appraisal theory perspective (i.e. Levine & Pizarro, 2006) that emphasizes the organizational value of discrete emotions to adaptively deal

with the emotion-eliciting situations. Anger is activated at the times of experiencing or anticipating goal failure and compensation may be better achieved with either the recall of specific information that is directive for reinstatement of accomplishment of the goal. Therefore, after recalling anger-related events, retrieval process may focus on the events that are central and informative (Talarico, Berntsen, & Rubin, 2009) to prevent further goal-failure, which also serves individuals to effectively regulate the emotions induced by anger-related appraisals.

Differences in the importance ratings of different emotion groups may be explained from the perspective of appraisal theory as well. We found that recalling sadness-related memories resulted in the retrieval of less important memories subsequently. However, reappraisal tendency further clarified the effect of specific emotions. Only individuals with high reappraisal tendency recalled memories of important events after recalling sadness-evoking experiences. Sadness-related appraisals lead individuals to turn inward and increase self-evaluations in relation to emotion eliciting events (Power & Dalglesih, 2008), by which relative importance of experiences is reconsidered and priorities may be changed (Uzer & Gülgöz, 2014). Therefore, it is likely that, in order to compensate for the sadness, high reappraisers recalled events that they attribute greater importance as a way to degrade the relative importance of the preceding recall.

For individuals with high reappraisal tendencies, emotional memories resulted in retrieval of not only more important, but also more intense memories. We argue that such an increase in the event centrality and affective strength for these individuals indicate effective implementation of emotion regulation strategies, in this case, reappraisal. There are various routes by which reappraisal targets negative emotions (McRae et al., 2012), but in general, regulation involves changing the meaning of the emotion eliciting stimulus to be congruent with the current context (Gross & John, 2003). Therefore, it is no surprise to observe the retrieval of more important memories that are psychologically closer, because, psychological closeness is very much related

to the extent that an event is affectively hot and influential in one's life. Although distancing may be considered as a function of the event centrality (Demiray & Jansenn, 2014), it is also possible for individuals to selectively retrieve such affectively hot events to utilize them for emotion regulation.

Emotional intensity is likely to be a by-product of reappraisal process, such that after recalling negative events, individuals, but only high reappraisers, retrieved emotionally more intense events, which aims to facilitate the counter-regulation of negative affect. However, in contrast to our expectations, we failed to observe any difference in the valence of subsequently recalled memories. One reason for this may be that affective quality of memories may be better reflected on the emotional intensity, rather than the valence (Talarico, LaBar, & Rubin, 2003), because, valence-related judgements rely on reflections on an event in the current context whereas emotional intensity is associated with physiological arousal. The other reason is that, comparisons based on memory type are made across sadness, anger, and neutral memory groups. However, the memories we requested from the individuals in the neutral group were not affectively neutral, which may have hindered the valence-specific effects on the subsequent recall. Although most of the memories were rated as neutral or positive, there were many negative memories in the neutral group. The specific emotion eliciting the neutral memory varies across individuals as well. For that reason we also focused on how individuals were feeling after recalling different types of memories.

Regulation success based on post-report emotionality

Autobiographical memory recall has been used as a method for emotion induction in a number studies. Accordingly, we asked for sadness and anger related events to elicit negative emotions and, for a comparison, we asked for random events that individuals may experience in their daily lives. We did not specifically mention 'neutral' in the recall instruction, because, this

may bias them to think about emotionality of events. However, individuals in this neutral memory group came up with very positive as well as very negative memories. For this reason, we repeated our analyses using the direct affect ratings provided after the initial memory recall. We believe that this further enhanced the strength of the current evidence for a thorough discussion of the emotion regulation of the autobiographical remembering.

First, valence-based differences became more salient, in that, individuals who were feeling more negative retrieved more positive events in the subsequent recall, supporting for a counter-regulation account. These events were perceived psychologically closer and recalled with enhanced sense of reliving, both of which are likely to serve to increase their regulatory function. Even individuals reporting daily events, if they were feeling negative after the recall, were oriented to recall positive experiences in order to compensate for the negative affect. It is notable that we observed the role of reliving and psychological distance in both the analyses based on memory type and those based on post-report emotionality. The former one is the feeling as if the event is currently happening and the latter, psychological distance, eliminates the passage of time and reflects on subjective judgments of the extent the event is affectively hot and active in memory representation. Accordingly, both of these features are related to the salience of the event memory, pointing out their role as a catalyzer to regulate negative emotions in autobiographical remembering.

More importantly, the effect of reappraisal in relation to post-report emotionality was found on dimensions of importance and intensity . High reappraisal tendency resulted in individuals to recall memories with more importance and intensity. This indicated that reappraisal operates on the importance and intensity of the autobiographical recall in accordance with regulatory goals. In contrast to individuals with higher reappraisal tendency, those with low level of reappraisal tend to experience prolonged negative affect, which further supports for a counter-

regulation account. Selective recall of important and intense memories in the subsequent recall may facilitate degrading the priority attributed to the initially recalled events. Consequently, individuals can easily shift their attention to the current context by eliminating the emotion-eliciting information. In a similar vein, recalling psychologically closer memories, with enhanced sense of reliving, may intensify the relative salience of the subsequent memory, and in a way, serves affective distancing, which is also a form of reappraisal (McRae et al, 2012).

Although we provided no explicit instructions to regulate emotions, we found that individuals who are better equipped with regulatory skills (i.e. high reappraisers) automatically oriented to the information in accordance with the emotion goals. Previous studies also discussed the implicit (Koole, 2009) or covert (Aldao & Dixon-Gordon, 2014) emotion regulation strategies both of which emphasized the automatic mechanisms that generation and regulation of emotions operate. We consider such a perspective as important because emotional processing in their daily life is mostly spontaneous; otherwise, continuous attempts to monitor and regulate emotions would be mentally exhausting. Individuals do not consciously attend to or distract from emotional stimuli, but when they feel that they perceive particular stimuli, either negative or positive, that are more central than the others, and they attend. Similarly, in response to an emotional experience, they do not consciously utilize reappraisal, if this is not their habitual way of responding. However, regulatory goals are activated automatically, driven to effortlessly modify the emotional state (Mauss et al., 2007).

We argue that autobiographical remembering is also a way of emotion regulation. Individuals may recall positive experiences in response to situations evoking negative emotions. For example, when current goals are not attained, individuals may recall past accomplishments to enhance their self-esteem or recall what they did in the past to deal with the current obstacles. Alternatively, they may modify their priorities, even implicitly, and focus on the instances that

are more important to them. A detailed recall to form a positive imagery with intense affective reliving may further enhance the function of autobiographical remembering to regulate emotions. In doing so, individuals generally are not aware of their regulatory attempts, but their memory representations become more salient to serve the regulatory goals.

The relationship between emotion regulation function and memory has also been discussed within the functional account of autobiographical remembering, suggesting that the way individuals remember past experiences serves an important function and emotion regulation is one of them (Alea & Bluck, 2003; Bluck et al., 2005). Accordingly, we also argue that phenomenology of the recall has substantial influence on the extent to which the regulatory goals are attained. Positive experiences may be more efficient in alleviation of the negative emotions if they are recalled with higher sense of reliving and if they are perceived affectively hot. Especially at times when emotional intensity is high and individuals are unable to distract themselves from the negative affect, regulation may not count on the positivity (Opitz et al., 2012) and regulatory goals act on the memory importance in a way to retrieve more important events in their lives.

Overall, in the present research, we provided supporting evidence for the emotion regulatory function of autobiographical memory, showing that negative emotional states resulted in the retrieval of affectively hot and positive experiences recalled with a sense of reliving. The specific type of emotion in the negative memories influenced subsequent recall as well. Anger-evoking event led to the memories with intense reliving and imagery whereas sadness influenced the importance feature. Such differences were in line with the emotion-specific appraisals. In order to compensate for the anger associated with goal failure, affective and perceptual representations became more available, resulting enhanced recollection. On the other hand, since, sadness is elicited in the end-point when the event is finalized its regulation requires the modification of the event importance. Thus, in the subsequent recall, events with greater

importance were likely to be retrieved. One thing to note is that we demonstrated individual differences in the implementation of the regulatory function of remembering. Only individuals who are habitual reappraisers are able to utilize remembering for emotion regulation. They were automatically oriented to select the memory representation to compensate for the negative emotionality. It is also possible that, since reappraisal is an early regulation strategy in the emotion generation process, high reappraiser individuals intervene the emotional processing before emotions become very intense, making regulation easier and less effortful.

Limitations and Future Directions

Our findings contributed to the growing literature on the relationship between memory and emotion regulation by empirically showing the influence of emotion regulation goals on the autobiographical remembering. There are, however, some limitations to the present research. First, we used a neutral-memory group as a control to emotional memory groups. However, not all memories reported were neutral; there were very negative and positive memories. Recall of negative events may activate counter-regulation mechanisms as in the emotional memory groups, whereas recall of very positive memories may lead to congruence effects in the subsequent recall (Singer & Salovey, 1988; Rusting, 1998). Also recent evidence showed that neutrality may be associated with ambivalence about feelings (Schneider, Veenstra, van Harreveld, Schwarz, & Koole, 2015). Although in their research Schneider and colleagues (2015) focused on the valence ratings of emotional pictures, their findings may apply to autobiographical memories as well. Therefore, for a more rigorous comparison, in future research positive memories may be used as a control for negative memories. This will also broaden our understanding regarding whether counter-regulation mechanisms are utilized for the positive emotionality in the same way as for the negative emotionality.

A second limitation is that we did not ask for how participants were feeling after the subsequent recall, which would inform us about the extent of the regulation success. We eliminated the priming influence by examining the valence differences between initial and subsequent recall, however, we do not have any information about on the relative influence of phenomenology of the subsequent recall and reappraisal on the efficacy of emotion regulation. In the future research, inclusion of emotionality ratings for specific emotions (i.e. anger, sadness) as well as emotionality after the subsequent recall may help us to better monitor the affective changes through remembering.

Despite some common methodological problems, our findings have important implications for future research. We demonstrated the regulatory function of autobiographical memory in the short term, just after the elicitation of the negative affect. However, it is also important to observe how such regulatory efforts are reflected on the following remembering phase, which may further inform us about the longevity of the effect. Moreover, current findings are based on the implicit forms of regulation and we consider it equally important to understand the influence of conscious emotion regulation on the phenomenology of autobiographical recall. Addressing this, future research may use explicit instructions to regulate emotions (i.e. reappraise, suppress) and examine the role on the specific strategies on the affective and recollective features of the autobiographical remembering. Finally, there are differences in the experience of emotions induced by video clips, pictures, and autobiographical recall (Lench et al., 2011). Pictures and video clips involve more visual representations and therefore, affective changes may require more perceptual, especially visual, imagery. Autobiographical recall, on the other hand, involves more mental elaboration with narrating and abstraction and thus linguistic processes are highly involved. Efforts to regulate recall-induced emotions may be reflected on the

meaning making processes of the autobiographical memory such as event importance or psychological distance.

In conclusion, the general idea we argue for is that, emotion regulation function of autobiographical memory ensures phenomenological form of the memory to be constructed to optimize regulation success. The events that are represented in the optimal phenomenology for an affective change are more likely to be retrieved, especially in individuals with effective regulatory skills. In that sense, current evidence has promising implications, showing what we remember is not that random, but interacts with both our internal states and the ways we use to regulate internal states.

Conclusion

The empirical work presented in three chapters focused on autobiographical memory functions in different contexts. Remembering is conceptualized as an interface, with multiple components, in between the individual and the context, therefore, in each study, individual differences were considered as well. In the first chapter, we examined the role of adult attachment in remembering memories of romantic relationships. In the second chapter, we addressed the functions of rehearsal mechanisms in remembering achievement- and failure- related events. The first two studies, in general, emphasized the self and directive functions, however, the third chapter specifically investigated the emotion regulation function of remembering to better understand the role memory phenomenology in regulating emotions.

In the first study, we had two major goals. One was to characterize the mechanisms of remembering and the unique phenomenological features indicating each mechanism. We proposed three core memory components that are event, rehearsal and phenomenological characteristics. Event characteristics constitute the centrality of the event and represents how

important, how intense, self-defining and consequential the event was for the individual. Rehearsal-related mechanisms, on the other hand, operate after encoding and determine how the memory evolves through time. Phenomenological characteristics, however, pertain to the retrieval mechanisms, and are mostly related to the recollective properties such as intensity, imagery, reliving, at the time when people report memories. The model we proposed model resulted in a good fit both for positive and negative memories, but also revealed functional differences related to the valence of the event. More specifically, irrespective of the valence, rehearsal mediated the link between event features and the phenomenology, indicating that event centrality has no predictive power for phenomenology at recall unless event is not rehearsed frequently. Furthermore, arousal at the time of the event, independent of the subjective meaning of the event, directly predicted the quality of recollection. On the other hand, for positive memories, event characteristics also influenced the phenomenology. The more important positive events are perceived, the better they are recalled independent of the passage of time or the frequency of rehearsal. Current evidence is also important, providing further support for the self-enhancement function of positive memories (Bluck et al., 2005) as well as for the tunnel memory effect of arousal (Berntsen, 2002), that intensifies recollection.

Our second goal in the first study was to examine how adult attachment styles, attachment anxiety and attachment avoidance were reflected on the distinct components of remembering. As we expected, self-regulatory goals associated with anxiety and avoidance. For attachment anxiety, the goal is to remain vigilant for relational information. Therefore, frequent rehearsal serves to keep relational events, both negative and positive ones, salient and enhance the quality of remembering. On the other hand, for avoidance, lack of intimacy is relieving, therefore, highly avoidant individuals tend to limit the encoding process, especially for positive events. This is also

functional for them, because, with such a form of remembering, positive experiences do not challenge their relational schema. Overall, first study demonstrated how current goals for self-regulation organize autobiographical remembering in a way to modulate what to attend or what to recall in the current context.

In the second study, we focused more on the directive function of remembering. For that reason, we investigated memories associated with past goals and tested how rehearsal processes shape achievement and failure related events are represented over time. As an individual difference variable, specific forms of rumination, brooding and reflection, were also examined to understand their relative influence on the way rehearsal processes transform the memory experience. As we expected involuntary remembering serves to keep memories salient in the memory, especially by providing specific event details popping into mind. Voluntary remembering operated on the psychological distance, however, the effect was observed only for achievement memories, leading individuals to perceive such positive events psychologically closer. The effects of ruminative tendencies were distinguished as well. Whereas reflection reduced the quality of recall, brooding enhanced the memory experience in general, and more importantly, these effects were mediated by involuntary recall. Findings of the second study are important, first by showing distinct functions served by voluntary and involuntary rehearsal. Also, distinct mechanisms operating in relation with brooding and reflection pointed out that what is functional may be different across individuals and this may shape memory processes accordingly.

In the first two studies, we discussed mostly the self and directive functions. In the third study, we focused on a specific aspect of self function that is emotion regulation. We expected that when individuals are feeling negative, recall of positive memories may serve to up-regulate

positive affect by counterbalancing the negative affect. In order to test this, we first induced negative affect, sadness or anger, and then we asked individuals to report any memory that comes to their mind. This spontaneous recall is not an effortful process though, thus, we argued that emotion regulatory goals guide the memory retrieval subsequent to the emotion induction. Specific emotions were examined, because, sadness and anger are associated with not only distinct appraisals, but also distinct goals for emotion regulation. Accordingly, we expected differences in the memory experience depending on whether remembering is utilized to regulate anger or sadness.

In line with our predictions, memory type influenced the phenomenology of the subsequent recall. Specifically, regulation of the sadness required the retrieval of more important memories whereas anger resulted in more intense recollection of events. Valence differences in the subsequent recall appeared when we considered how individuals were feeling after emotion induction. Supporting for a counterregulation mechanism, the more negative individuals were feeling, the more positive memories they recalled subsequently. Furthermore, we observed that not all individuals are such efficient to regulate their emotions that only the ones with high reappraisal tendency recalled more important and emotionally intense memories in response to negative affect. Overall, third study provided empirical evidence for the emotion regulation function of autobiographical memory, demonstrating the role of memory phenomenology in the up-regulation of the emotional state. Current findings also revealed particular memory features, such as importance and intensity of the memory, facilitating the regulatory effect of remembering. Multi-modality of the autobiographical memory becomes more evident here and in relation to this, we argue that changes in emotional state may be associated with any memory

feature (i.e. importance, psychological distance) other than the valence as such features may modify the salience of the event.

In conclusion, three studies in this dissertation provided novel insights to the literature in terms of both the theory and the methodology. In the first two studies, we showed that what is functional may not be identical for every individual and every context, which underlines an idiosyncratic approach especially when studying memory functions. Also, the third study demonstrated the role of autobiographical memories in emotion regulation, and to our knowledge, there has been no empirical evidence testing the regulatory function of remembering. In terms of the methodology, we adopted a modelling approach in order to understand the dynamic interplay of the memory components. This further allowed us to figure out the causal interactions between the individual and autobiographical remembering, which, we believe, has promising implications for the future research in autobiographical memory.

Appendix

	Items
Event Characteristics	
1. Event Intensity:	I felt intense emotions at the time of the event
2. Importance.	It is an important event in my life.
3. Consequentiality.	This memory has consequences for my life because it influenced my behavior, thoughts, or feelings in noticeable ways.
4. Self Definition	It is one of the events that tells much about who I am
5. Valence*	As I recall them now, I would you rate the emotions I experienced during the event as… (to very negative to very positive)
Rehearsal Characteristics	
1.Talking	Since it happened, I have talked about this event.
2.Voluntary Thinking	Since it happened, I have thought about this event.
3. Involuntary Thinking	Since it happened, the event has come to my mind unintentionally
Phenomenological Characteristics	
1. Current Intensity	I can feel now the emotions that I felt then
2.Reliving	As I remember the event, I feel as though I am reliving the original event.
3. Auditory Imagery	As I remember the event, I can hear it in my mind.
4. Visual Imagery	As I remember the event, I can see it in my mind.

*This item was not included in the model, but was used to check for the valence of the reported memory.

Footnotes

[1]We further tested the model in which error variances were also constrained to be equal for both types of memories however at this level, the model diverged significantly from the scalar invariant model, even when we considered the artificial inflations in chi-square due to the number of constraints. This indicated that observed variables, in other words, unique items representing memory qualities, were not measured identically across groups. Measurement invariance at this final step was expected and actually we were primarily concerned for the variation at this level so that we could examine the item-specific differences arising from the individual differences in levels of anxiety and avoidance.

[2]In order to test the consistency of the measurement model across different memory types, additional analyses were conducted with the data collected in our lab. We used data coming from self-defining, emotional, goal-related memories, all of which were collected with an almost similar procedure. The factor structure, as well as factor loadings were found to be invariant across memory types, $\Delta \chi^2 < 20.090$ ($\Delta df = 8$). Links between the indicators and the latent constructs were found to be significant with the exception of self-definition and importance for goal-related memories. In further analyses, chi-square difference for the model of invariant intercepts was found to be significant, however, the intercepts for the self-definition and importance were not constrained, partial invariance of the intercepts were established. Partial invariance of the intercepts ensures the equality of the comparable elements in the model (Byrne, Shavelson, & Muthen, 1989; Dimitrov, 2006) and for current purposes, model of equal factor loadings was considered sufficient to demonstrate the consistency of the latent construct across different memories.

[3]Although the effect was moderately significant ($p = .05$), the effect was considered significant since the values corresponding to 95% confidence intervals did not involve a zero point (Cheung & Lau, 2008; Preacher & Hayes, 2008).

[4] Autobiographical remembering has been characterized by three constructs (Fitzgerald & Broadbridge, 2013; Öner & Gülgöz, 2016) with event characteristics (event intensity, importance, self-definition, consequentiality), rehearsal characteristics (voluntary and involuntary remembering) and recollection (current intensity, imagery, reliving), however here, we focused only on the latent factor of recollection. Therefore, we not only tested the measurement invariance of the recollection construct but also we conducted multi-group confirmatory factor analysis using the three latent constructs. After we validated the configural structure of the recollection factor with three indicators, we proceeded to test the multi-group invariance of the measurement specifically for this factor. Such an approach is stricter, ensuring that memory items loaded on the intended constructs (i.e. the item about importance did not load on the recollection factor).

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