THE EFFECT OF ANXIETY-RELATED THOUGHT SUPPRESSION ON MEMORY PROCESSES, AND ITS RELATION TO DECREASED INTERHEMISPHERIC INTEGRATION

GÜLCAN AKÇALAN
105627008

İSTANBUL BİLGİ ÜNİVERSİTESİ
SOSYAL BİLİMLER ENSTİTÜSÜ
PSİKOLOJİ YÜKSEK LİSANS PROGRAMI

YRD. DOÇ. DR. HASAN BAHÇEKAPILI
2008

The Effect of Anxiety-Related Thought Suppression on Memory Processes, and Its Relation to Decreased Interhemispheric Integration

Kaygı Yaratan Bir Düşüncenin Bastırılmasının Bellek İşlevlerine Etkisi ve Bastırmanın Beynin İki Yarım Küresi Arasındaki İletişim Düzeyiyle İlişkisi

Gülcan Akçalan
105627008

Asst. Prof. Dr. Hasan Bahçekapılı : .....

Asst. Prof. Dr. Murat Paker : .....

Prof. Dr. Mine Özmen : .....

Approval Date : .....

Total Page number : 138

Key Words
1) Thought Suppression
2) Memory
3) Interhemispheric Integration
4) Repression (Psychoanalitic)
5) Neuropsychoanalysis

Anahtar Kelimeler
1) Düşünce Bastırması
2) Bellek
3) Hemisferler arası iletişim
4) Bastırma (Psikanalitik)
5) Nöropsikanaliz

Thesis Abstract

The effect of anxiety-related thought suppression on memory processes, and its relation to decreased interhemispheric interaction

Gülcan Akçalan

The present study investigated the effect of thought suppression on different forms of memory systems (recognition, recollection, familiarity, and perceptual priming) and its relation to degree of handedness through interhemispheric processing. A nonclinical sample of 178 undergraduates was randomly divided into four conditions according to the type of memory task (either explicit or implicit) and the presence or absence of the suppression instruction. At the beginning of the session all subjects were exposed to an anxiety evoking slideshow which was used as a suppression target. The result of the study indicated no effect of mere suppression instruction on all forms of memory in all conditions (strongly right handedness vs. mixed handedness). However, analyses for suppression effort and suppression success revealed significant conclusions. Marginal impairment in general strength of recognition memory was observed when individuals manage not to think of unwanted thoughts by spending high effort. Under this condition the effect of perceptual priming was maintained. It is concluded that the disturbance in explicit memory performance resulted from rehearsal interruption associated with depleted cognitive resources.

Regarding the effect of thought suppression on interhemispheric coherence, the results indicated that successful thought suppression was associated with a decline in episodic memory performance of mixed-handed individuals. Therefore, a potential relation of thought suppression to decreased hemispheric integration was suggested. Finally, degree of handedness, but not suppression, was identified as a moderating factor in perceived negativity.

The implications of the findings for psychoanalytic theory of repression and psychotherapy are discussed.

Tez Özeti

Kaygı Yaratan Bir Düşüncenin Bastırılmasının Bellek İşlevlerine Etkisi ve Bastırmanın Beynin İki Yarım Küresi Arasındaki İletişim Düzeyiyle İlişkisi

Gülcan Akçalan

Bu çalışma kaygı yaratan bir düşüncenin bastırılmasının çeşitli bellek sistemlerine (tanıma, biriktirme, aşinalık ve örtük bellek) etkisini ve bastırmanın el asimetrisiyle ilişkisini (beynin iki hemisferi arasındaki iletişim düzeyiyle ilişkisine dayanarak) incelemiştir.

178 tane klinik bir durumu olmayan üniversite rasgele, bastırma yönergesinin olup olmamasına ve bellek testinin çeşidine göre (belirtik ya da örtük) dört farklı gruba bölünmüştür. Deney oturumunun başında katılımcılar kaygı uyandıran bir slayt gösterisi izlemişlerdir. Bunun ardından serbest çağrışım yazısı sırasında bastırma yönergesi olan gruptan, bu resimleri düşünmemesi istenmiştir. Çalışmanın sonuçları sadece bastırma yönergesi almış olmanın bellek süreçlerine bir etki olmadığını göstermiştir. Bununla birlikte, bastıma çabası ve bastırma başarısı üzerine yapılan analizler önemli bulgular sunmaktadır. Katılımcılar çok çaba sarf ederek başarılı bir bastırma gerçekleştirdiklerinde resimleri doğru olarak hatırlamakta zorlanmışlardır. Diğer taraftan ise bu durumda örtük bellek performanslarında herhangi bir bozulma gözlenmemiştir. Belirtik bellek performansındaki bozulmanın sebebi olarak, bastırma sonucu enerji

kaynaklarının tükenmesi ve buna bağlı olarak tekrarlama sürecinin sekteye uğraması sonucuna varılmıştır.

El asimetrisi ile ilgili analizlerde, belirgin bir el kullanma tercihi olmayan katılımcıların episodik bellek performanslarında bastırma sonunda bir düşüş gözlenmiştir. Güçlü bir sağ el kullanma tercihi gösteren katılımcılarda ise böyle bir düşüş görülmemiştir. Bu bulgulara dayanarak başarılı bir bastırmanın, beynin iki hemisferi arasındaki aktivasyon uyumunda bir bozulmayla ilgili olabileceği görüşü önerilmiştir. Son olarak da sonuçlar, dış dünyadaki olumsuzlukları algılamada belirgin bir el kullanma tercihi olmayanların daha dayanıklı olduğu bulunmuştur. Bastırmanın ise kayda değer herhangi bir etkisi gözlenmemiştir.

Psikanalitik bastırma teorisine ve psikoterapiye dair çıkarımlar çalışmanın sonuçları ışığında tartışıldı.

Acknowledgments

I owe many thanks to many people whose contributions and support made this thesis possible.

I would like to express my deepest gratitude to my thesis advisor Asst. Prof. Hasan Bahçekapılı for being with me whenever I felt lost and exhausted during this long process. His critics and challenging questions about Psychoanalysis shaped my mind and research interest. His dedication himself to grow scientific minds contributed immensely to my academic development. I owe him a great deal for his valuable guidance, support, trust, encouragement and time.

I thank to committee member Asst. Prof. Murat Paker for his openness to help and trust in me. I am also grateful to the other committee member Prof. Mine Özmen for her enthusiasm and giving her precious time to read this study in detail. Their feedbacks and suggestions immensely enhanced my motivation for further research.

I owe special thanks to Asst. Prof. Esra Mungan and Assoc. Prof. Ali İ. Tekcan for their essential contributions to the development of the experimental procedure of this study. Their critical feedbacks and new ideas improved my thesis. I would like to express my thanks to all faculty members at Boğaziçi University for contributing my academic development and allowing me to use their samples to gather data.

I thank to Dr. Saffet Murat Tura for allowing his time to listen my research ideas and offering his valuable advice.

I would like to express my great thanks to Çağlar Taş for her valuable contributions to the development of my experimental apparatus. I am also grateful to Seren Talaşman and Nihan Özgen for dedicating their substantial amount of time to collect data for my thesis. Hejan Epözdemir provided me the Turkish standardized version of the Symptom Assessment-45 Questionnaire. I want to thank to her, too.

I would like to express my gratitude to TÜBİTAK for contributing my graduate education by providing me a substantial amount of scholarship.

I own many thanks to the faculty members at İstanbul Bilgi University for their support and generous helps whenever I need. I am thankful to my assistant friends at İstanbul Bilgi University for their support and encouragement. I want to express my special thanks to Hale Ögel for her patience to my endless questions.

I would like to thank to all my friends for their enduring support. I own special thanks to Dilşad Koloğlugil for her faithful friendship. Such a long journey of psychology education would be colorless and dreary without her. I also want to thank to Deniz Tahiroğlu for being with me even though she is miles miles away from Turkey.

Finally I would like to express my gratitude and love to my mother, Ayşe Akçalan, my father, Ahmet Akçalan, and my sisters, Gönül Katırcı and Hamide Akçalan for their patience, unconditional love and belief in me. I am especially indebted to Hamide Akçalan for making my hard times tolerable with great understanding. I feel privileged to have such supportive and loving sisters. I would like to dedicate my thesis to my family.

Table of Contents

Tables

Figures

Appendices

Chapter 1: Introduction

> …The grief that does not speak
>
> Whispers the o'er fraught heart, and bids it break.
>
> (Shakespeare, 1603-1606)

One of the criticisms towards the arguments of psychoanalysis is that they lack empirical support based on public evidence. Most of the psychoanalytic theories are still based on knowledge coming from case studies. Although this is a valuable source of knowledge, it might be difficult to replicate and generalize that knowledge to all population. That has been the common reason for the disapproval of psychoanalytic theories by many scientists. On the other hand, recent developments in cognitive science and neuroscience (e.g. implicit memory, subliminal perception, fMRI studies, infant studies, and etc.) open a way to discuss the premises of psychoanalysis in a more scientific setting. One objective of this study is to investigate the psychoanalytic theory of repression with an experimental design. Another criticism towards psychoanalytic theories, particularly repression theory, has been that theorists focus on the consequences of psychic mechanisms rather than the mechanism itself. For instance, what mechanisms underlie repression is not been well known yet. Thus, this study attempts to contribute to understanding underlying mechanisms of

psychoanalytic concept of repression via applying thought suppression paradigm.

1.1 Emotion Regulation

In everyday life we face many unpleasant thoughts and feelings. In order to deal with these unpleasant situations we use different strategies. Campos and his colleagues (2004, p. 380) defined "emotion regulation as the modification of any processes in the system that generates emotion or its manifestation in behavior". According to them emotion regulation does not involve just the emotion processes that occur after an emotion is elicited. Rather, emotion regulation comprises all processes before the generation of an emotion, during the activation of it and after that (Campos et al., 2004).

Emotion regulation mainly involves interactions between the functions of cortical and subcortical brain regions (Ochsner, & Gross, 2005). Subcortical regions, particularly the limbic system, are the emotion-generative center of the brain (LeDoux, 1998). Limbic system appeared earlier during evolution and contains primitive and simple structures of the brain which are also present in many species. Hippocampus and amygdala are the two important parts of the limbic system. While the hippocampus primarily regulates learning and memory, the amygdala is specialized in emotions, such as "feelings and expressions of emotions, emotional memories, recognition of the signs of emotions in other people" (Carlson, 2004, p. 86). Cortical regions play an inhibitory role in the activation of these emotion-generative structures (LeDoux, 1998). Cortical inhibition

exists at a baseline level for each person. Campos and his colleagues (2004, p. 380) suggested that "in many cases, the elicitation of emotion is as much a function of the release of existing inhibition". According to this view all human emotion experiences are somehow regulated.

LeDoux (1998) identified a descending pathway between the medial prefrontal cortex (PFC) and the amygdala in his studies on rats. When the rats' medial PFC was damaged, they needed much more time to extinguish their aversive conditional behaviors. In this regard, interaction between cortical and subcortical systems on emotion regulation involving aversive stimuli may be specifically through the pathway between the medial PFC and the amygdala. Davidson, Jackson, and Kalin (2000) speculated that it is the left PFC that primarily inhibits the activity of amygdala.

Early studies of emotion regulation began with Freud's theory of defense mechanisms. Today, although Freud's many ideas have been disputed by contemporary theorists, almost all psychologists accept the existence of defense mechanisms. Emotion regulation mechanisms are categorized differently by different theoretical orientations. Psychoanalytic way of categorizing emotion regulation mechanisms involves primary (primitive) defensive processes and secondary (higher-order) defensive processes (McWilliams, 1994). Defenses that involve the issues about "boundary between the self and the outer world" are referred as primary or primitive defenses (p. 98). The latter one refers to defenses that "deal with internal boundaries, such as those between the ego superego and the id, or between the observing and experiencing parts of the ego" (p. 98). Primitive

defenses include withdrawal, denial, omnipotent control, idealization-devaluation, projection-introjection-projective identification, splitting, and dissociation. Higher-order defenses include repression, regression, isolation, intellectualization, rationalization, moralization, compartmentalization, undoing, displacement, reaction formation, and sublimation (McWilliams, 1994). Primitive defenses occur early in life, while higher-order defenses require more developed cognitive and brain organizations. Due to unconscious nature of defense mechanisms, they are difficult to be empirically examined. Nevertheless, observational and self report methods provided evidence for different types of defenses; their hierarchical order; and their relation to psychic organizations, such as personality, psychopathology, self-esteem, interpersonal relationships and therapeutic alliance (e.g. Bond, 2004; Ekehammar, Zuber, & Konstenius, 2005; Fransson, Sundbom, & Hagglof, 1998).

Gross (2002) identifies three features of emotion regulation that are applicable to all theoretical orientations. First, not only negative emotions are subject to regulation, but also positive emotions are regulated, such as increasing or maintaining them. Second, emotion regulation includes both conscious and unconscious processes. That is, it can occur intentionally or automatically. Finally, emotion regulation may be either adaptive or maladaptive. Some forms of emotion regulation can be adaptive for some people and not for others. Moreover, even the same emotion regulation strategies can be adaptive for the same person for some times but not for other times.

1.2 Suppression

1.2.1 Expressive Suppression vs. Thought Suppression

One of the emotion regulation strategies being paid special attention by many researchers is suppression. Suppression strategies occur after an emotion is generated (Gross, 2002) and can be categorized in two groups. The first is expressive suppression. Suppression of emotional expression involves a deliberate attempt to cover behavioral expression of emotional experiences (Gross, 1998). The second is thought suppression. Thought suppression is inhibiting unwanted thoughts through trying not to think about it (Wegner, 1987). Thought suppression is regarded as an effortful attempt to get rid of a distressing thought from consciousness. In everyday life we spend a substantial amount of energy by trying not to think of our worries, regrets, failures, habits that we want to quit, situations in which we have felt embarrassed, and etc.

Valentiner and his colleagues (2006) compared Wegner's thought suppression with Gross's suppression of emotional expression in terms of whether they are conceptually two different phenomena. They developed a 16-item questionnaire consisting of questions related to thought suppression and expressive suppression strategies. The result of factor analysis indicated that although these two constructs go hand in hand, they represent different phenomena.

1.2.2 Psychoanalytic Defense Mechanism of Repression

Thought suppression is compatible with Freud's concept of repression. Repression, as conceptualized by Freud (1915), is a way of protecting self from distressing thoughts by keeping them away from consciousness. Freud (1915) divides repression into two types. Primary repression involves impulses, affects or events belonging to early years of life. Because these are never encoded through conscious mechanisms of the mind, they are never recollected consciously. Secondary repression occurs in later years of life, in response to unbearable emotions, events or desires. The latter is the scope of this study.

Freud's explanation of psychopathology mainly relies on repression mechanism (Freud, 1915). According to his view, all psychic acts are organized in line with pleasure principle. That is, organisms' main motivation is to gain pleasure and avoid pain. Freud uses a 'flight-reflex' metaphor for repression: "These processes strive towards gaining pleasure: psychical activity draws back from any event which might arouse unpleasure" (Freud, 1911, p. 219). While this withdrawal works for keeping 'clear' the conscious part of the mind from unpleasurable stimuli, its effects are seen through unconscious mechanisms, such as "resistances, symptoms, dreams, distortions of conscious representation, amnesia, inhibitions, and childhood fears" (Freud, 1911, p. 378).

Ironically, repression has been seen as associated with detrimental effects on the self rather than its expected protective function (Freud, 1915). According to Freud (as cited in Boag, 2007) repression process involves

disintegration of affect from thought. Through this process the strength of the thought decreases and it eventually disappears from consciousness. This process of weakening the thought will involve the dissolution of the links between the thought and its context. Repression process only makes stop the existence of unwanted thoughts, feelings, wishes, or images in consciousness (Freud, 1915). On the other hand, repressed materials maintain its existence in the unconscious layer of the mind. Because of the absence of rational mechanisms and appropriate true associations of these materials, repressed thoughts even become stronger by developing new false connections (Freud, 1915). As these connections develop, they need more energy to be repressed. Such a process costs an enormous amount of "psychic energy" (Freud, 1915).

1.2.3 Thought Suppression vs. Psychoanalytic Repression

Traditionally, the main distinction between suppression and repression is that while suppression involves conscious mechanism, repression operates unconsciously (Geisler, 1985). Thinking through Freud's conceptualization of mind, in repression unwanted thoughts and memories are pushed into the unconscious, whereas in suppression they are pushed into the preconscious. Therefore, suppressed thoughts can more readily come into the consciousness in the presence of reminder cues. On the other hand, psychoanalytic theorists suggest that repressed thoughts are never recollected consciously, we can just see their influences on behavior. Erten (2006) defined suppression as refusing to think and thus eventually

forgetting unwanted thought, and repression as forgetting that that unwanted thought has been forgotten. When one engages in suppression one day, the next day s/he may remember his forgetting.

There are some differences among the psychoanalytic authors in terms of conceptualizing repression and suppression. Some argued the presence of conscious components in repression, so that suppression and repression are somewhat compatible (e.g. Erdelyi & Goldberg, as cited in Geisler, 1985). More commonly accepted view is that they are different but related. In this regard, suppression and repression represent two poles of a continuum from conscious to unconscious (Brenner, as cited in Werman, 1983). As Ross (2003, p. 65) put into the words,

> *"…percepts, as well as images are at first consciously suppressed because they are sources of danger, of fear, and subsequent shame in a psychosocial context of consensual disingenuousness. Only after erupting into awareness are they then intrapsychically disclaimed and thereafter forgotten - preconsciously disavowed and, subsequently, unconsciously repressed."*

Hinsie and Campbell (as cited in Werman, 1983, p. 407), also claimed that suppression may precede repression by signing the target to be repressed. According to them,

> *"[Suppression] is the act of consciously inhibiting an impulse, affect, or idea, as in the deliberate attempt to forget something and think no more about it. Suppression is thus to be differentiated from repression which is an unconscious process. It is probable that there is no sharp line of demarcation between suppression and repression, and it seems also likely that on occasion the unconscious defense of repression may be directed against material which the individual consciously suppresses. Nonetheless, it seems advisable in most instances to regard suppression and repression as distinctly different mechanisms."*

Jones (1993) contributed to the theories on the distinction/relation between repression and suppression such that she came up with five types of repression. First is called preverbal infantile repression (same as Freud's primary suppression), the second is post-verbal infantile repression (nonverbally encoded experiences), the third is state-dependent repression (experiences encoded during an altered state of consciousness), the forth is conditional repression (previously conscious experiences are repressed through classical or operant conditioning), and the final is automatized suppression. Jones (1993) described automatized suppression such that unwanted ideas, feelings, images or wishes are first deliberately refused to be thought. This conscious effortful attempt gradually becomes automatized, thus eventually unwanted materials are kept away from awareness automatically. Namely, they are repressed. In that sense, only

automatized suppression type of repression includes a suppression mechanism that precedes repression.

1.2.4 Experimental Studies on Ironic Process of Thought Suppression

Suppression is defined as a way of avoiding distressing, unwanted stimuli by consciously trying not to think about them in the previous section. It is assumed as conscious counterpart of unconscious repression mechanism. A growing number of studies have been conducted in order to test Freud's theory of repression. Although it is difficult to study with repressed materials in experimental conditions due to their unconscious nature, suppression which involves conscious mechanisms reveals opportunities for experimental explorations. In this regard, exploring the mechanism and consequences of thought suppression somehow helps us to get insight into its mechanisms and consequences. Therefore, such studies reveal significant indications for the nature of psychological problems and therapeutic work.

According to the literature, as Freud suggested for overuse of repressive style, thought suppression is too not associated with promising consequences. Wegner and his colleagues (1987) investigated thought suppression with experimental design. They introduced the "white bear paradigm" which involves trying not to think of white bear for five minutes either before or after a five-minute expression period. The findings revealed

an increase in the number of thought of white bear during expressive period following suppression relative to that period preceding suppression period.

Based on their research on suppression, they defined two steps in thought suppression process: one includes the operation of plans and strategies for thought suppression and the second is maintaining of thought suppression by checking whether the method of suppression works well. According to their view, increased susceptibility to unwanted thoughts after suppression derives broadly from the processes underlying the second step. The suppression of the thought of white bear depends on the selection of what is not white bear. Every thought during the suppression period is generated with a link to the thought of white bear. When subjects are allowed to think of anything, the most of the thoughts coming to mind are those recently viewed. Thinking of those thoughts in every time activates the implicit connection to the target thought. Therefore, every recent thought acts as a cue that primes the target thought. They proposed that narrowing such distracting thoughts to a particular thought rather than allowing the possibility of many of them will decrease the number of intrusive thoughts during expressive period. The result of the study was compatible to their proposal. When subjects were provided with a particular distracting thought (i.e. red Volkswagen) in order to get rid of the thoughts of white bear reported less post-suppression intrusion than those without a particular distraction. The "negative cueing" explanation, as called by Wegner and his colleagues (1987), for thought suppression effects is compatible with Freud's (1915) explanation of repression process

suggesting that repressed thoughts stay in the unconscious by developing new connections.

Rebound effect of thought suppression has also been justified outside of the laboratory settings. For instance, in the study by Trinder and Salkovskis (as cited in Wenzlaff & Wegner, 2000) individuals showed a similar rebound effect in their daily life when they tried to suppress their already existing intrusive thoughts. Thus, it can be concluded that the findings of experimental studies on thought suppression are adequate to explain suppression occurred in the real world.

It has been postulated that thought suppression underlies the development and maintenance of psychic problems, especially anxiety disorders. Threatening thoughts induce more motivations for suppression in order to keep the pleasurable state. The more one tries to suppress an unwanted thought, the less likely one finds opportunity to work through this thought and reconstruct it in a way so that it no longer provokes negative emotions. Therefore, to be suppressed thoughts turn to intrusive thoughts on which the individual feels out of control. Many studies have proved the role of thought suppression in the development and maintenance of psychopathology, particularly post traumatic stress disorder (e.g. Harvey and Bryant, 1998), obsessive-compulsive disorder (e.g. Janeck and Calamari, 1999) and depression (e.g. Wenzlaff and Bates, 1998). Those studies suggested that individuals with such psychopathology suffer from personally relevant intrusive thoughts when they try to suppress them more than nonclinical individuals. Clear evidence indicating the relation of

thought suppression to the severity and duration of symptoms has been found.

The more threatening one finds a stimulus, the more s/he is inclined to avoid from it. On the other hand, it is not so easy to avoid highly emotional stimuli. For instance, Davies and Clark, (as cited in Wenzlaff & Wegner (2000) observed that emotional stimuli lead to an increased number of intrusions following a suppression period as compared to neutral stimuli. Cougle and his colleagues (2005) investigated the interactive effect of suppression and anxiety on the occurrence of unwanted, threat related thoughts. In their study, subjects with social anxiety tried harder to suppress the target thought (a personal social threat) when they were induced anxiety (anticipation of public speech). Accordingly, they showed an increased number of intrusions. However, in the absence of an anticipation of threat, no such increase in intrusion frequency was observed under suppression condition. This may exemplify that suppression of increased anxiety lead to more intrusions.

There are mixed findings in terms of the indication of post-rebound effect of suppression in the literature. One possibility of nonincreased intrusive thoughts after suppression in some occasions may be maintenance of suppression during the expression period or subjects' unwillingness to report their intrusions. Geraertsa and his colleagues (2006) compared the short-term and long-term effect of suppression, with the expectation that the presented possibilities for the failure will be lessen in the long run. During the experiment, only repressive participants (highly defensive and low in

trait anxiety) did not show post-rebound effect. On the other hand, looking at a-7 day report of intrusive anxious thoughts, repressors were intruded more frequently than the other participant. Geraertsa et al. (2006) interpreted the results of the study such that "repressive coping enables individuals to avoid negative and trauma-related thoughts in the short run, but in the long run, repressive coping leads to intrusive thoughts about these negative targets" (p. 1458). Commonly, post rebound effect of suppression has most robustly been demonstrated when mental control was disrupted by a cognitive load during suppression, such as rehearsal of nine-digit number, imposition of time pressure, and etc. (e.g. Wenzlaff & Bates, 1998; Macrae, Bodenhausen, Milne, Ford, 1997, and Wegner & Erber, 1992). This topic will be discussed in the following section in more detail.

1.3 Memory

"Memory refers to the persistence of learning in a state that can be revealed at a later time (Squire, as cited in Gazzaniga, Irvy, and Mangun, 2002, p. 302). Hypothetically, memory includes three stages. First, information is encoded, then stored, and finally retrieved (Gazzaniga et al., 2002). At the first place, memory is divided into two major types: short-term memory and long-term memory. Short-term memory has short retention time (seconds or minutes), whereas in long-term memory information is stored for days or years (Gazzaniga et al., 2002).

The main interest of the present paper is long-term memory. Long-term memory also includes two subdivisions, each of which has differential

domain of learning, “neural architecture and developmental timetable” (Tulving, 1985). Explicit/declarative memory involves a conscious process of retrieving information that was learned before. There are two kinds of explicit memory. Episodic memory is associated with past events, such as personal, autobiographical experiences. The other is called semantic memory which includes factual knowledge, such as world knowledge, object knowledge, and language knowledge, (Gazzaniga et al., 2002). Information stored in explicit memory system can be either linguistic or sensory, and it is organized by language, and so can be declared (Cozolino, 2002).

On the other hand, implicit memory involves an unconscious process. Four forms of implicit memory were identified: Procedural memory involves “motor (e.g. knowledge of how to ride a bike) and cognitive skills (e.g. acquisition of reading skills)” (Gazzaniga et al., 2002, p. 315). The second involves perceptual priming through which performance on a task is facilitated by an earlier experience without the awareness of the causes of such facilitation. (Gazzaniga et al., 2002). Another form of implicit memory involves classical conditioning and the final one involves nonassociative learning (e.g. habituation, and sensitization) (Gazzaniga et al., 2002). The information stored in implicit memory cannot be verbalized. Experiences are encoded fragmentally into implicit memory. It is activated by “subtle situational cues” in a reflexive manner. Information stored in implicit memory includes “habits”, “skills”,

"reflexive behaviors", "conditional and emotional learning", and "unconscious rule structures" (Cozolino, 2002).

Neuroscience studies revealed that explicit and implicit memory are two distinct mechanisms. Studies with brain damaged patients showed clear evidence for intact implicit memory performance in the absence of explicit memory, and vice versa (for a review see Gazzaniga et al., 2002). Explicit memory primarily relies on the hippocampus and prefrontal lobe. On the other hand, different forms of implicit memory involve different brain regions. For instance perceptual priming (visual or auditory) is related to the right occipital lobe, procedural memory is placed on the basal ganglia and the cerebellum (a structure of subcortex), and emotional conditioning involve the amygdala (Gazzaniga et al., 2002). Simplistically and roughly, it has been hypothesized that explicit memory is primarily ruled by cortical regions of the brain (vertical analysis) and related to the left hemisphere activity (horizontal analysis). For implicit memory the opposite condition has been assumed (Cozolino, 2002).

Many researchers have empirically demonstrated that although knowledge in implicit memory does not come to awareness, it still affects human reactions. For instance according to Damasio's somatic marker hypothesis (1994) past experiences are associated with certain bodily emotional reactions within the memory system. When one is in a similar situation, these reactions are automatically activated even without conscious recollections of the past experience. Neither the cause of such bodily

sensations nor bodily sensations themselves may reach consciousness, but their influence can be seen in decisions of actions.

Another important feature of implicit memory is that the information stored within implicit memory system is invulnerable to the passage of time. This phenomenon has not been observed for explicit memory system. Mitchell (2006) demonstrated 17-year-persistence of information in implicit memory store. In this study, subjects' implicit memory performance (assessed through picture-fragment identification test) was higher for the pictures that they saw 17 years ago for new pictures. No such difference was found among control subjects who were presented with none of these pictures before. The results are impression in terms of indications the persistence of perceptual priming effect over at least 17 years.

1.3.1 Memory and Emotion

Bower's model (1981) attempts to explain the nature of relationship between memory and emotion. According to this model emotions are represented by particular sets of nodes within the network. Along with the network and schema models, nodes of an event and nodes of the emotion are aroused together during the event, and develop connections. When emotional nodes are stimulated, this activation primes the nodes of associated events, and vice versa. As Barry, Naus, and Rehm (2004) conceptualizes, unconscious activation of an emotion or event within memory system (even those that are in implicit memory) may be explained through this process.

One of the important considerations within memory research is the effects of stress on memory system. On the face of stress, hypothalamus-pituitary-adrenal (HPA) axis is stimulated and thereby the secretion of stress hormones called glucocorticoids (GC) increase (Kandel, 1999). This increase blocks the functions of the hippocampus which has sensitive receptors to GC, which in turn leads to overactivation of the amygdala due to the lack of cortical inhibition (Sapolsky, 2004; LeDoux, 1998). Severe or prolonged stress causes impairments in memory system guided by hippocampus (i.e. explicit memory). Inability to remember traumatic memories is related to this mechanism. On the other hand information during the times of severe or prolonged stress is acquired through amygdala-based implicit memory system. Furthermore, as LeDoux (1998) suggested, since the amygdala is free from the control of the medial prefrontal cortex, these unconscious memories become more resistant to extinction. In the study by Packard and Wingard (2004), injection of anxiogenic drugs into the amygdala leads rats to depend on procedural learning. Thus, they concluded that "increasing levels of emotional arousal, at least to a particular threshold, may selectively impair ''cognitive'' memory function, and thereby favor the use of ''habit'' memory systems" (p. 248).

Although the events stored in the amygdala remain unconscious, they influence the conscious behaviors. In the study by Bechara and his colleagues (1995), a neutral stimulus (conditional stimulus) was associated with an aversive stimulus (such as electric shock- unconditional stimulus). Damage in the hippocampus did not interfere with normal conditional

physiological reactions, but led to inability to realize that their responses to the conditional stimulus are due to it was once associated with the unconditional stimulus. On the other hand, in the situation of amygdala damage, such patients could verbalize their anticipation that when conditional stimulus was presented, the unconditional stimulus would follow it. However, no conditioned fear responses were observed (for a review see Phelps, 2006).

Sapolsky (2004) summarized the neurobiological mechanism by which stress affects memory system. He claimed that increased secretion of GCs disrupts the growth and strengthening of the connection among neurons (synapses) within the hippocampus. Because memories are represented by synaptic configurations, in the absence of such synaptic stimulation, forgetting occurs.

On the other hand, in the situations of mild stress, increased explicit memory performance is in place. It has been demonstrated by many studies that information with emotionally arousing connotations are more likely to be retrieved than nonemotional ones (Hamann, 2001). From evolutionary perspective, emotionally arousing stimuli more readily capture attention because they carry life saving value. Cognitively, emotional stimuli involve increased rehearsal, enhanced attention, and thus high elaboration (Hamann, 2001). Specific neural and hormonal mechanisms also play important roles in enhancing effect of stress, such as a growth in synaptic connections triggered by mild increase in the secretion of GC.

1.4 Suppression and Memory

1.4.1 Explicit Memory (recall and recognition) and Suppression

A growing number of investigators have conducted studies in order to explore the effect of thought suppression on memory processes. For explicit memory performance, the findings are mixed. While some studies yielded enhancement effect of suppression on memory for the target stimuli others indicated its detrimental effects on memory.

A substantial number of researches have demonstrated an association between suppression instructions and impaired memory performance for target material. Anderson and his colleagues (2004) explained the mechanism of this relationship such that "stopping retrieval of an unwanted memory impairs its later retention" (p. 232). They (2004) proposed a think/no think task to study thought suppression. In this study design subjects were first trained on word pairs, then presented with one of the words in pairs and asked either to think or not to think about its pair. Finally, they performed an unexpected memory task (cued recall). They found that to-be-suppressed items were recalled less than to-be thought items.

Directed forgetting is another paradigm for making individuals get involved in suppression of unwanted thoughts. Similar to thought suppression, in directed forgetting paradigm subjects are first presented with the stimulus to-be-suppressed/forgotten, and then asked to suppress/forget it. A typical directed forgetting method (Bjork, 1970) involves the presentation of a list of words. After the presentation of each word or a

group of words subjects are instructed to either remember or forget it/them. At the end, subjects were provided with an unexpected memory task (recall or recognition) which was composed of both to-be-remembered and to be forgotten words. It was demonstrated that 'forget' instruction was associated with impaired memory performance as compared to 'remember' instruction. Common explanation for such results has been retrieval inhibition of forget items (e.g. Geiselman, Bjork, & Fishman, 1983).

Thought suppression and directed forgetting involve voluntary mechanisms in order to avoid target thought. Inhibition of a thought can also be created involuntarily. Retrieval-induced forgetting paradigm is an example of such an unintentional process (Anderson, Bjork, & Bjork, 1994). This paradigm depends on the notion that associated items compete with each other for being recalled. When one item is attempted to retrieve, other associated items are activated too. If one particular thought is retrieved by a cue and not the competing thought, the competing thought becomes inhibited and is forgotten. Storm, Bjork and Bjork (2005) tested this paradigm on recall for human traits. The associated traits that were not retrieved during the study phase recalled less than even control items (that were not presented before). Wessel and Hauer (2006) demonstrated retrieval induced forgetting effect on autobiographical memories, and Barnier, Hung, and Conway (2004) did on emotional memories.

Interestingly, even simply engaging in suppression of emotional expressions resulted in impaired memory performance, just as involving self-distraction (Richards and Gross, 2005). Self distraction is another way

of inhibiting a particular thought by thinking alternative thoughts other than the target, i.e. distracters. Individuals who tried either to suppress their facial expressions or to think about something else when they were watching a-64-sec. surgical film showed a worse recognition performance for the film than those who received no instructions. Importantly, memory performance even got poorer as people tried harder to suppress.

The authors of such studies explained the underlying mechanism of detrimental effect of suppression based on the "resource depletion theory" (Wegner & Erber, 1992). For instance according to the Easterbrook's (1959) cue-utilization hypothesis, emotions and some form of emotion regulation strategies deprive attentional resources and leave little of it for memory processes. Likewise, as Wegner and his colleagues (1987) indicated, the cognitive control (operator and monitoring process) involved in suppression process demands considerable amount of cognitive resources.

Evidence for the notion that decreased memory performance following suppression is because suppression process expends the available cognitive recourses for memory process comes from the study by Klein and Bratton (2007). In their experiment, they varied the complexity of cognitive task (sentence verification task) and memory type (nonemotional, nonpersonal negative and personal negative memories). After thinking about the target thought for three minutes, subjects were asked to either suppress or think about the target thought for the next three minutes. Afterwards, they were provided with one of the sentence verification tasks (low, moderate, or high complexity). They found that suppression is related to an increase in

response time especially when the complexity of the cognitive task is high. These results indicate that thought suppression costs on cognitive resources.

Rachman (as cited in Klein and Bratton, 2007) stated that emotional stimuli are cognitively more demanding in order to be suppressed. “Recent research on affect and cognition suggests that emotions with negatively high emotional valence tend to promote detail-oriented, attentive and piecemeal information processing style” (Fiedler**,** as cited in Wyland & Forgas, 2007**,** p. 1515), which is similar to the process operating in suppression (an attentive and focused thinking about alternative, distracting topics) (Wegner et al., 1987). Nevertheless, this kind of operational style has even greater cost on cognitive recourses. In the study by Klein and Bratton (2007) detrimental effect of suppression on cognitive functions was highlighted when suppression target involved negative personal experiences.

Depue, Banich and Curan (2006) investigated how suppression of emotional and nonemotional information affects differently memory performance by using think/no think paradigm. Along with previous research, they identified that emotional targets were remembered better than neutral targets when they were not to be suppressed. On the other hand, this aspect of emotional information makes it harder to be suppressed; thus emotional information needs greater cognitive control (i.e. cognitive resource) to be suppressed. As indicated by the findings of their study, to be suppressed emotional information was recalled less than to be suppressed neutral information.

It is important to note that there is no sufficient empirical study showing a single underlying mechanism that mediates the relationship between intentional forgetting/suppressing attempts and memory systems. Alternatively, as Fleck and his colleagues (2001) suggested, retrieval and/or encoding deficits may account for impaired memory performance following suppression attempts. In their study with directed forgetting paradigm, participants were provided with an interference task either during the study phase or memory task. Recognition process was found to be mainly mediated by selective encoding (relevant vs. irrelevant) rather than retrieval inhibition. Another explanation for the effect of suppression on memory systems is that engaging in intentional forgetting deprives opportunity for rehearsal of the target thought. Rehearsal is important for the duration of maintenance of newly acquired information in short-term memory. Longer maintenance of information in short term memory ensures the transference of information to long-term memory (Gazaniga et al, 2002). Such deprivation of rehearsal by suppression task may result in fading out the target thought within memory.

On the other hand Sherman, Stroessner, Loftus and Deguzman (1997) provided evidence for enhanced memory performance for to-be-suppressed stimuli. In their study participants listened to a group of stereotypical and non-stereotypical features of a social group in order to form impressions. Participants who were told to suppress their previous stereotypes about the group showed a highlighted accuracy of recognition for stereotypic features as compared to non-stereotypic features. Moreover,

their performance was higher than the participants with no suppression instruction.

Macrae and his colleagues (1997) claimed that detrimental effect of suppression occurs only when there are plenty of cognitive resources for the completion of a successful suppression process. In their experiment on suppression of stereotypic information, participants who were primed for to-be-forgotten items previously, did not exhibit a directed forgetting effect. They explained this phenomenon such that attentional valence of the target was increased by priming, and such a highly demanding stimulus required a greater cognitive resource to be suppressed. Similarly, an improved recall performance for to-be-forget items was observed when participants engaged in a simultaneous cognitive task during suppression of to-be-forgotten items. Engaging in a simultaneous cognitive task during suppression is thought to disrupt a successful suppression process by depleting the available cognitive resources.

Along with Wegner's (1987; 1992) proposal of two-step mechanism in suppression process, Macrae and his colleagues (1997, p.716) explained these results based on the attentional inhibitory mechanism operating in suppression process which requires plenty of cognitive energy. When cognitive resources are depleted by an ongoing demanding cognitive activity, suppression process fails, which results in intrusions of target stimuli in working memory (i.e. rehearsal effect) (Macrae et al., 1997). Therefore, just like the process underlying the post-rebound effect, a decreased operator activity combined with an increased monitoring activity

amplifies the accessibility of recollections of target stimuli. Failure in inhibiting the unwanted thought accompanied by highlighted attention leads to enhanced memory performance (Wenzlaff, & Wegner, 2000).

Wegner, Quillian and Houston (1996) pointed that it is not the accurate retrieval of content, but the accurate retrieval of the sequence of target episode that is affected by suppression attempt. They presented subjects with nonemotional film clip either to be suppressed or thought about during the day. The third group of the sample received no instruction for thinking. After 5 hours, their memory for the content of the film and the sequence of the film scenes were assessed. Neither recall nor recognition performance was impaired or improved due to the suppression instruction as compared to thinking and no- instruction groups. On the other hand, suppression group made more mistakes when retrieving the order of the film than did the other groups. Furthermore, suppressed group was more likely to indicate fragmented memories for the film rather than having a continuous image of it. The findings of the Rassin's (2001) study were parallel to Wegner's study. No considerable effect of thought suppression on the accuracy of the recollection of target story was found. Furthermore, memory representations of the suppression group were more like snapshots than those of the thinking group, but not than those of the no-instruction group.

A large number of studies have investigated the effect of intentional forgetting/suppression on memory process. On the other hand, there have been discrepancies among the findings of these studies. Some possible explanations of such discrepancies can be listed as follows:

First of all, variation in experimental procedure may account for the mixed results. For instance, thought suppression and directed forgetting are two methods to initiate forgetting. However there are substantial differences between these two paradigms. At the first place, the difference between thought suppression and directed forgetting is that in directed forgetting paradigm there are both to-be-forgotten and to-be-remembered materials, whereas in thought suppression paradigm there are experimental groups or time periods for suppression in order to make comparisons. Furthermore, in thought suppression paradigm subject is to report the intrusions of target thought. Directed forgetting usually results in increased retrieval of 'remember' items compared to 'forget' items. However, thought suppression usually increases intrusions of to-be-forgotten material, but for memory performance the nature of its effect has not been clear yet. (Whetstone & Cross, 1998). According to Whetstone and Cross (1998), the difference between thought suppression and directed forgetting paradigms in terms of memory performance results from monitoring process that operates in thought suppression and associated with the intrusion- report instruction. When they tested their hypothesis, the results yielded that directed forgetting effect was not observed in the presence of the report instruction. In the study conducted by Wegner and his colleagues (1996), subjects in suppression group were instructed not to think about the film clip, they had just watched, for the following 5 hours; and they were not asked to report the intrusions during the day. No difference in memory performance for the content of the film clip was observed.

Another reason for inconsistent findings in intentional forgetting/suppression studies may be the variation in the characteristics of target material. For example, suppression of a single item rather than an episode generated different results. Even thought there is no direct comparison study, suppression of a single thought/item is more likely to be associated with improved memory for particular thought (e.g. Wegner et al., 1987), whereas suppression of an episode is more inclined to produce memory impairments (e.g. Wegner et al., 1996). Furthermore, attempts to suppress stimuli that capture more attention, such as being highly emotional, personally relevant or complicated, result in reduced memory performance as compared to suppression of attentionally less demanding stimuli (e.g. Rassin, 2001; Depue et al., 2006; and Klein, Bratton, 2007). However, this hypothesis has been challenged by Macrae's et al. (1997) finding that increase in attentional valence via priming resulted in difficulties to suppress that target. On the other hand, such discrepancy may result from the failure of successful suppression induction in the study by Macrae and his colleagues. Macrae and his colleagues (1997) did not control whether subjects successfully manage not to think of to-be-forgotten items. Demanding targets are hard to be suppressed and thus associated with increased numbers of intrusion. Because of that a particular attention for checking the level of suppression success should be devoted in order to make more definite conclusions.

Finally, type of retrieval task (recall vs. recognition) may be responsible for the divergence in suppression/forgetting studies. Although

some studies identified no difference in sensitivity of recall and recognition memory (e.g. Wegner et al., 1996), most of the studies indicated that recall memory is more vulnerable to forget instructions than recognition memory (e.g. Whetstone and Cross, 1998). As well as the variations in retrieval process as presented above, suppression effect on later memory performance may be mediated by factors influencing encoding and/or retention process.

Paradoxically, it has been suggested that the inadequacy of cognitive resources is responsible for both enhanced accessibility of the target thought and impaired memory for it. Therefore, poor memory performance after suppression might occur only when suppression of the target thought is successful, that is in the absence of intrusive thoughts during the suppression period.

1.4.2 Familiarity and Recollection Memories, and Suppression

While undermining effect of thought suppression on memory is commonly identified by researchers, the nature of this effect relatively received little attention. For example, according to the dual-process theory of recognition there are two cognitive processes underling recognition memory, i.e. two types of recognition memory (Yonelinas, 2002). One type of recognition judgment is based on conscious recollection of information. Recollection involves a controlled, detailed process through which information is retrieved with its context and associations. In that sense, recollection is similar to the process operating in recall memory (Yonelinas,

2002). The other recognition judgment mainly depends on a sense of familiarity without recollection of any details or associations about information. Familiarity relies on the mechanism that automatically checks whether the target information matches with the stored information in memory (Yonelinas, 2002). Due to its automatic nature, familiarity is more immune to memory impairments. For instance, it has been showed that whereas disruptions in attention when learning a material impaired recollection considerably, judgments based on familiarity were affected to a smaller extent (Jacoby & Kelly, as cited in Parker, Relph, & Dagnall, 2008).

Remember-know paradigm developed by Tulving, (1985) is the mainly used method to find out the nature of contributions to recognition memory. In this method, subjects are to indicate whether they retrieve any detail related to the recognized item (remember response), or they are just sure about seeing the item before without any recollections (know response). Remember responses represent recollection, and know responses represent familiarity process. Familiarity process is just like that sometimes we are sure about knowing a person before but we are unable to remember any detail about him such as his name, the context we meet him, and etc. Remember-know judgments do not reflect memory confidence. In order to prevent misuse of know judgment as indication of guessing, and to allow participant to make more accurate judgments Eldridge, Sarfatti, and Knowlton (2002) included a “guess” alternative.

It has been demonstrated that familiarity and recollection rely on different brain regions. While damage in hippocampus was associated with

impaired recollection, damage that extended to surrounding structures in the medial and interior temporal lobe (e.g. parahippocampal gyrus) was associated with impairment in both recollection and familiarity (for a review see Aggleton & Brown, 1999). A substantial literature, as reviewed in Yonelinas (2002, p.471), consistently indicated that "the hippocampus and the prefrontal lobe is critical for recollection, whereas the surrounding temporal lobe regions are critical for familiarity". More specifically Blaxton and Theodore (1997) identified laterality of familiarity and recollection. The deficit in left hemisphere temporal lobe was related to lower recollection, while the deficit in right hemisphere temporal lope was associated with lower familiarity.

Yonelinas (2002) proposed that recollection is quite similar to recall, thus what affects recall performance can affect recollection performance. For example, attention deprivation during retrieval reduces recall memory, but not recognition. Along with this information, recollection memory may, too, be vulnerable to deprivation of attentional resources (for a review see Yonelinas, 2002). However, according to the author's knowledge this proposal has not been tested yet with remember-know procedure. Spitzer and Bauml (2007) applied retrieval induced forgetting paradigm on remember-know judgments in order to demonstrate the retrieval induced effect on recollection. Unexpectedly, they observed no impairment in recollection of unpracticed items as compared to control items in retrieval inducing forgetting, but an expected decrease in general memory strength was found. Nonetheless, Verde (2004) showed a detrimental effect of

practicing a particular item during retrieval on recollection of the unpracticed associated item.

To sum up, under the light of these findings, recognition memory is composed of two independent processes which involve different domain of cognitive processes, different neurobiological structures and different level of susceptibility to external factors. Inconsistencies among the studies examining the effect of forget/suppress instructions on recognition memory can be explained by the dual process nature of recognition memory. It is be possible that different individuals may predominantly rely on one type of process rather than the other when deciding whether they saw the item previously.

1.4.3 Implicit Memory and Suppression

Freud suggested long before repressed information may fade out within explicit memory, but not within implicit memory, thus it still keeps its influence over mind. As many studies have indicated a decrease in explicit memory performance after suppression, a reverse condition has been observed for implicit memory performance.

The proposal that thought suppression is associated with an increase in implicit memory performance has been proved by the studies measuring unconscious cognitive processes, and behavioral and physiological responses (for a review see Wenzlaff & Wegner, 2000). For instance Wegner and his colleagues (1990) demonstrated an increase in skin conductance level associated with suppression of an exciting thought.

During the monitoring of subjects' thoughts over 30 minutes under suppression condition, intrusions of exciting thought into the consciousness were associated with elevated skin conductance level whereas under think condition no such a relationship was observed. These results revealed that although suppressed thoughts disappear from consciousness for a while, they are very likely to be followed by uncontrolled intrusions into the mind without losing their emotional connotations.

Furthermore, Wegner and Smart (1997) identified a "deep cognitive activation" buried in unconscious mechanisms. That is, even though people may not be aware of their suppressed thoughts; the influences of those thoughts are evident on the tasks involving unconscious processes. For example, the sentence unscrambling task is a method for assessing unconscious processes. With this procedure Wenzlaff & Bates (1998) demonstrated the role of suppressed depressive thoughts in the development of risky behaviors. The results of the study indicated that when high risk takers were successfully engaged in thought suppression (i.e. in the absence of a cognitive load during the sentence unscrambling task), they showed no evidence for depressive thoughts. However, they revealed an increased number of depressive statements when they were imposed a cognitive load during the sentence unscrambling task (a way of deprivation of the opportunity for successful suppression) (Wenzlaff & Bates, 1998). Stroop task is another common method for measuring implicit memory. Wegner and Erber (1992) demonstrated Stroop interference for suppressed thoughts.

That is, participants were slower in indicating the color of to-be suppressed targets under cognitive load as compared to target-unrelated words.

The studies cited above mainly illustrate unconscious intrusions of suppressed thoughts. More direct evidence for conservation of suppressed thoughts within implicit memory came from McKinney and Woodward (2004). They identified directed forgetting effect in all kinds of explicit memory tasks (free recall, cued recall, and recognition), but not in the implicit memory task (word completion task).

Resistance of implicit memory to directed forgetting effect was also indicated by Storm, Bjork and Bjork (2005). They found a typical directed forgetting effect on recall for human traits associated with different pictures. However inhibiting particular information and making the associated one more ready to come into the mind even involuntarily did not change subjects' impressions formed previously. Along with the repression theory, as Bjork and Bjork (e.g. 2003) suggested in their research on directed forgetting, even though there is no conscious access to the specific information, its impact is still obvious on judgments and behaviors.

Fleck and his colleagues (2001) found directed forgetting effect on implicit (assessed through lexical decision task) memory as well as on explicit memory (assessed through recognition task). More specifically, to-be remembered words were identified as word vs. non-word more quickly in implicit task, and recognized more accurately and faster during the explicit task. Moreover, they demonstrated different underlying mechanisms of directed forgetting effect in two memory systems. According to the results

disruptions in retrieval mechanism by an interference task eradicated the directing forgetting effect, whereas those in encoding process did not diminish directed forgetting effect in implicit memory. Therefore they concluded that retrieval deficit has a greater contribution to directed forgetting in implicit memory. More specifically, "directed forgetting in implicit memory probably results from the differential excitation of Remember and Forget cued word representations at retrieval", and is not because of "retrieval inhibition of irrelevant information" (p. 217). On the other hand, in recognition process it is encoding regulations rather than retrieval that are responsible for directed forgetting effect.

1.5 Neurobiological Foundation of Thought Suppression

Neuropsychoanalysis is a relatively new field in the scientific arena investigating the neurobiological foundations of the psychoanalytic constructs. Therefore, the followers of this school study to provide psychoanalysis a scientific setting. In an attempt to find the neurobiological mechanisms underlying repression, different views have been generated by psychoanalytic authors. Although they tried to elaborate their hypotheses with clinical evidence (especially from patients with brain damage), many of them still lack direct experimental evidence.

Psychoanalytic concepts of conscious and unconscious memory are similar to explicit and implicit memory concepts of cognitive science, respectively; nevertheless they are not the same (Cozolino, 2002). Depending on the type of memory, such as sensory, motor, emotional, and

semantic, different brain regions are responsible for different types of memory (McCarty, as cited in Cozolino, 2002). “Systems of memory bridge top-down and left-right pathways” (Cozolino, 2002, p.91). Top-down pathway involves cortical and subcortical structures of the brain. While explicit memory systems lie within the layers of the cortical and hippocampal areas of the brain that are present only in higher-order living things and developed after birth; implicit memory systems lie in the primitive structure of the brain that are developed from birth (Cozolino, 2002).

Anderson and his colleagues (2004) looked at the brain activities of subjects though fMRI under suppression and no suppression conditions in order to find out the neural mechanisms underlying suppression. Increased activity was observed in the brain regions responsible for executive control, particularly the dorsalateral prefrontal cortex (DLPFC), during suppression in comparison with retrieval episodes. The more the DLPFC activation is, the more memory inhibition. Interestingly, suppression success was associated with increased hippocampal activation. That is, during the final memory task there was more activation in the hippocampus when to-be-suppressed words were forgotten than when they were remembered. On the other hand, a reverse phenomenon was in place for to-be-thought words. That is to say, there was more activation in the hippocampus when to-be-thought words were remembered. These findings indicated that “the hippocampus and DLPFC interact during the attempts to suppress recollection of an unwanted experience” (Anderson et al., 2004, p. 234).

Another neuropsychoanalytic conceptualization of repression is left-right pathway. During evolution, left and right hemispheres of the brain have been specialized for different mental functions. It has been claimed that verbal activities, analytical and serial information processing are located primarily on the left hemisphere. On the other hand, functions such as nonverbal and perceptual activities, synthesizing, and holistic processing are dominated by the right hemisphere (Carlson, 2004). It has been suggested that the right hemisphere has much more connections to the limbic system, the subcortical region of the brain, than the left hemisphere (Cozolino, 2002). However, for most of the brain functions neural circuits of left and right sides work collaboratively. "When we speak of functions of the right or left brain, we are more accurately referring to functions that are represented more fully in one hemisphere than the other" (Cozolino, 2002, p. 106). In fact more complex, high-level mental functions, such as empathy, attribution of intention, comprehending stories, and appreciating humor, require well coordination among different neural circuits distributed throughout the left and right hemispheres of the brain (e.g. Gallagher & Frith, 2003). Corpus callosum, a large bundle of neural fibers, is the brain region primarily responsible for interconnecting the two hemispheres of the brain so that we have unified perceptions and memories (Carlson, 2004).

Some of the psychoanalytic researches (e.g. Galin, as cited in Solms & Turnbull, 2002; and Schore, 2005) argue that psychodynamic conscious is posited in the verbal left brain and the psychodynamic unconscious is related to the nonverbal right brain. According to this view, the right

hemisphere, which is intact from early months of life, is primarily specialized for implicit information processing and the left hemisphere is mainly responsible for conscious processing (e.g. Hugdahl, as cited in Schore, 2005; and Happaney, Zelazo, & Struss, 2004). Cooperation between the functions of the two hemispheres results in a "coherent, continuous, and unified sense of self" (Schore, 2005, p. 831). In line with this proposal, repression is viewed as the result of the "functional disconnection" between hemispheres, and the corpus callosum is the region of the brain responsible for repression. (Solms & Turnbull, 2002). In that sense repression may be thought in the analogy of a blockage preventing the connections between certain information stored within the left and right hemispheres, thus disrupting an integrated sense of self. Likewise, Freud (1915) conceptualized repression as the lack of verbal representation from certain motives, thoughts or emotions; and talking is a very effective way of reconnecting verbal representations to the associated targets.

Along with split-brain studies (a surgical operation of cutting corpus callosum for treatment of epilepsy), which include differential presentation of particular stimuli to either the left or the right hemisphere, Solms and Turnbull (2002) suggested that the left hemisphere is "reflexively conscious" that is "being able to reflexively recall and articulate something" and different from "core consciousness (being aware of something)" (p. 247). Solms and Turnbull argued that we cannot simply equate the verbal activities of the left hemisphere to psychoanalytic term of consciousness, which include all executive ego functions such as, reality testing, and

coping. As seen in the case with left midtemporal damage, although the patient is unable to follow others' speech as well as her thoughts, she somehow maintained her ego functions. Furthermore, in contrast to expectations, patients with right hemisphere deficits are not more rational or realistic than normal population (Solms & Turnbull, 2002).

To sum up, identifying the right hemisphere as the unconscious and the left hemisphere as the conscious may be misleading. Nevertheless, we can assume that while the right hemisphere is more related to implicit mechanisms, the left hemisphere is more related to explicit processes. And their cooperation is important for sense of integrated experiences.

DeBellis and his colleagues (1999) identified a relationship between early child abuse and a reduction in the size of corpus callosum. They investigated the brain scans of 44 maltreated subjects' suffering from PTSD symptoms compared with 61 normal individuals. More specifically a significant correlation between increased dissociative symptoms and decreased corpus callosum size was observed.

A growing research has been attempting to investigate the role of interhemispheric integration in memory processes. The results of studies with neuroimagining techniques, behavioral measurements, or patients having particular brain damage have underlined the interhemispheric basis of episodic memories. The conclusion of these studies is that while encoding of episodic memory was related to increased left hemisphere activity, retrieval mainly depended on right hemisphere activities. In contrast, semantic memory involved unilateral activation of left hemisphere

(Tulving, Kapur, Craik, Moscovitch, & Houle, 1994). Furthermore, while split-brain patients had intact implicit memory, their episodic recognition memory was disrupted (Cronin-Golomb, Gabrieli, and Keane, 1996).

Christman and Propper (2001) found unilateral basis of implicit memory and bilateral basis of explicit episodic memory by applying behavioral techniques. They presented study stimuli (i.e. word strings) to different visual fields (right vs. left) of participants during encoding and retrieval. When the letters were presented to the opposite hemispheres during encoding and retrieval, an improved recognition performance was obtain. On the other hand, when letters were presented to the right visual fields (i.e. left hemisphere) both during encoding and retrieval, the speed of subjects in the lexical decision task (a way of assessing implicit memory) received more advantage (Christman & Propper, 2001).

Inducing bilateral, horizontal, saccadic eye movements is another behavioral method associated with increased hemispheric integration. Bakan & Svorad, (as cited in Christman & Propper, 2001) identified the equalization of levels of activation in the left and right hemispheres following bilateral eye movements. It is proposed that "equalized levels of activation in the two hemispheres facilitate interhemispheric integration, [because] "if the two hemispheres display different levels of activation, it may be difficult for the less activated hemisphere to "keep pace" and interact efficiently with the more active hemisphere" (e.g. Christman, Garvey, Propper, & Phaneuf, 2003, p. 222). Along with this argument, neurophysiological studies demonstrated increased electroencephalograph

(EEG) coherence when individuals perform a task which is operated by the structures of both two hemispheres. However, EEG coherence was not observed when performing tasks which include unilateral brain functioning (e.g. Morrison-Stewart, Velikonja, Corning, & Williamson, as cited in Christman, et al. 2003). A similar brain processing including increased EEG coherence was detected in during REM sleep, especially in the presence of horizontal eye movements (e.g. Dionne, as cited in Christman, et al. 2003). Based on the indication of these findings, a relationship between bilateral eye movements and increased interhemispheric interaction has been suggested (e.g. Christman, et al. 2003).

In the study by Christman and his colleagues (2003), an improvement in episodic memory performance (recognition of previously presented words and recall of autobiographical memories) was observed following engaging in 30 second-bilateral horizontal saccadic eye movement as compared to no eye movement and other types of eye movement conditions. No effect on implicit memory performance (word fragment completion) was observed.

Another common way of behavioral assessment of interhemispheric integration is measuring the degree of handedness. The assumption of the relationship between handedness and interhemispheric process is based on the findings which reveal a larger corpus callosum size in mixed-handed individuals (Witelson, 1985). As the size of the corpus callosum increases, so does the neural transmission across the corpus callosum as a result of equilibrating the activation between the two hemispheres (Liederman,

1998). It was found that the increase in interhemispheric EEG coherence coincides with the increase in the myelinization and maturation of the corpus callosum (between the ages of 2 and 7) (Yakovlev & Lecours, as cited in Christman, et al. 2003). Under the light of these findings, the corpus callosum may be the structure of the brain that mediates the coherence of the activation in the two cerebral hemispheres, thus regulating interhemispheric integration (Christman, et al. 2003).

Christman, Propper and Brown (2006) demonstrated a relationship between interhemispheric integration and the onset of childhood amnesia. The results of the study yielded that mixed handed participants retrieved episodic memories at an earlier age than strongly right handed individuals. Moreover, when the interhemispheric integration of strong handers was facilitated through bilateral, saccadic eye movement, they recalled earlier memories than control groups. This finding also indicates the effect of increased interhemispheric integration is especially robust during retrieval.

Propper and Christmant (2004) indicated no effect of hemispheric integration on recognition performance. On the other hand, while recognitions based on explicit recollections were associated with being mixed handed, familiarity based recognition was higher in strongly right-handed individuals. Nevertheless, Parker, Sarah and Dagnall (2008) indicated similar results with bilateral, eye movement method; they also indicated improved recognition performance as well as recall performance. Similarly Lyle, McCabe and Roediger (2008) demonstrated the advantage of being mixed handed for verbal paired associate recall performance and

source memory performance (which involve hemispheric integration), but not for face recognition performance and forward digit span performance (which involve unilateral brain activation).

1.6. Present Study

Previous studies revealed inconsistent results for the effect thought controlling on explicit and implicit memories. It has been demonstrated that while suppression resulted in deterioration in these memory performances in some cases, an enhancement was observed in the other cases. And some of them indicated no effect. The majority of these studies were conducted by using directed forgetting paradigm. Although thought suppression and directed forgetting paradigms have some commonalities, such as avoidance from the target thought and/or turning attention from the target by using distracters, they are not identical (Whetstone & Cross, 1998). Thought suppression paradigm is more compatible with psychoanalytic term of repression than directed forgetting is. Along with the purpose of the present study, namely bridging psychoanalysis and experimental indications, the particular interest of the present study is to explore the effect of thought suppression on memory systems. According to my knowledge, there are few studies directly investigating the relationship between intentional avoidance from anxiety-related thoughts and the nature of the subsequent memory for those thoughts. Rather primary aim of the existing studies is to examine the frequency of intrusive thoughts following suppression. Moreover, while most of the previous studies included verbal items to be suppressed, suppression of visual materials have received relatively less attention.

Nevertheless, visual stimuli are more capable of inducing emotional reactions, and in real world to be suppressed thoughts do not include only verbal stimuli, but also visual stimuli. Therefore, the first aim of the present study is to investigate the nature of the effects produced by suppression of anxiety-related visual stimuli on different memory systems. In line with resource depletion hypothesis, as well as rehearsal disruption explanation, impairment in explicit memory performance is expected. On the other hand, due to the high emotional valence of the target stimuli, participants are expected to have difficulties to suppress them successfully. On the basis of the literature, demanding materials consume more of the available resources, thus they are related with greater cognitive impairments for additional mental tasks. However, such situation is expected only when suppression attempts of individuals succeeded. On the other hand, demanding materials are difficult to be avoided; therefore they are more open to the opportunity for rehearsal through intrusions. Under the condition of suppression failure, along with the priming explanation for rebound effect, an enhancement in memory performance after suppression is expected (1^{st} hypothesis).

As a second hypothesis regarding explicit memory systems, a greater suppression influence is expected for recollection based recognition memory as compared to familiarity based recognition memory. Because recollection involves a controlled, detailed processing for developing associations between target stimuli and its context, it requires more cognitive work. Suppression of the target is thought to disrupt the process of

association-generation, depriving the person from the opportunity for working through the target thought. On the other hand, familiarity is mainly based on automatic processes and that feature is expected to protect it from adverse effect of suppression.

Similar to familiarity, implicit memory system relies on unintentional, effortless mechanisms. While distracters lead to the fading of explicit pathways of conscious retrieval, automatic monitoring process keeps priming the target thought. Accordingly, the third hypothesis of the study is that in the suppression condition an increase in implicit memory performance, or at least no change, is anticipated.

Previous studies identified hemispheric lateralization of episodic memory. Because of the bilateral nature of episodic memories, they are facilitated by equalized level of activation in two cerebral hemispheres. The other attempt of the present study is to find out any effects of thought suppression on decreased sense of integrated memories via decreasing the cooperation between the two hemispheres of the brain. In the present study, suppression is thought to involve a selective blockage in the corpus callosum that prevents the integration of target-related information within the left and the right hemispheres. In the present study the degree of handedness (mixed vs. strong) was assumed an indirect measure of interhemispheric interaction given the evidence that mixed handedness is associated with larger size of corpus callosum. A larger size of corpus callosum is thought to be an indication of greater interhemispheric integration (i.e. increased cerebral activation coherence). Because the

majority of the population is right-handed and in order to prevent a potential confound, only right-handed people were included in the present study. To sum up, as the forth hypothesis, greater impairment in explicit memory performance following suppression is hypothesized for mixed-handed individuals as compared to strongly right-handed individuals. This is because mixed handed individuals' benefit of increased hemispheric cooperation for episodic memory is assumed to be reduced under suppression condition, leading a greater cost for mixed-handed people. Furthermore, the most adverse effect of thought suppression for mixed handed individuals is expected to be on recollection based recognition memory (5^{th} hypothesis). This is because familiarity was found to include semantic representations that mainly rely on intrahemispheric processes. The final hypothesis regarding the second aim involves a similar prediction for implicit memory performance, due to the unilateral basis of implicit memory (6^{th} hypothesis).

The final aim of the study is to figure out the factors, such as suppression and degree of handedness, that affect the way we perceive negativity in the external world. As the seventh hypothesis of the study, suppression is not expected to reduce the negative valence of photos that participants perceived. Not to think about something distressing for a while would not probably moderate the way we feel when we later encounter it. As soon as we manage to avoid distressing thought and related feelings we may not experience distressing at conscious level. However, once it is reminded in some way, the associated feelings probably emerge again.

Furthermore, a healthy way of emotion regulation involves the interaction of different mental functions, namely the interaction of different structures of the left and right hemisphere. Therefore, mixed-handedness is hypothesized to be related to better regulation of emotions through hemispheric integration. Campos and his colleagues (2004) suggested that emotion regulation involves not only the processes following the elicitation of an emotion, but also the processes preceding it. Along with these arguments, mixed-handed individuals are expected to perceive the external world less negatively than strongly right-handed individuals (8^{th} hypothesis).

Chapter 2: Method

2.1 Participants

One hundred-seventy-eight right handed undergraduates volunteered in this experiment in exchange for course credit in the psychology courses. Participants were selected on the basis of some criteria assessed through a questionnaire (see Appendix B). Participants who were clinical (using drug and/or applying therapy for a particular psychological or neurological disorder) more than one month during the last year and/or at the moment they were taking the experiment were excluded from the study. Nineteen of the sample did not fulfill at least one of these criteria so they were discarded. Furthermore, nine of them did not follow suppression instruction at all, and 10 of them seemed as if they did not understand the memory task they are applied. No variety in the rates of emotional valence or remember-know judgments was accepted as indications of failure of following memory instructions. In total, 38 of the 178 data were dropped from analyses in order to increase the validity of the study. Finally 140 subjects, 112 female and 28 male with the mean age of 20.79 ranging from 17 to 28, were included in the study. All subjects had normal or corrected to normal vision and were native speakers of Turkish.

2.2 Materials

A personal information questionnaire including the inclusion criteria was developed by the author in order to determine the inclusion of the participants in the experiment. In addition, a Turkish standardized version of the Symptom Assessment-45 Questionnaire (SA-45) was used to check the presence of any psychiatric symptoms (see Appendix C). This inventory, helping to figure out the overall psychological distress level as well as the presence of particular symptoms, was developed by Maruish (2000). There were 45 items grouped in nine subcategories representing nine symptom dimensions. These dimensions were called as somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism. Items were responded on a 5-point-Likert scale from 0 to 4. The original form of SA-45 consisted of 90 items (SCL-R-90), the 53-item-version of this scale was later developed by removing the items whose factor loading was low Maruish (2000). Standardization of SA-45 for Turkish sample is being made by Epözdemir (2008).

The Edinburgh Handedness Inventory (EHI) (Oldfield, 1971) was used to measure participants' strength of handedness. This inventory consisted of 10 items. Test takers first indicated their preferred hand for the each particular activity, and then they were required to report the strength of their preference. This scale was translated into Turkish by the author (see Appendix D). Back translation was made.

Seventy-two pictures depicting the themes about well-known disasters all around the world were selected by the author as anxiety-inducing stimuli (see Appendices E, F, and G). These photos depicted earthquakes, fires, terrorist attacks, wars, hurricanes, nuclear and car accidents, violence, and famine that generally occurred within the last ten years. Emotional valence of each picture was rated by 15 clinical psychologists on a 5-point-Likert scale in a group session.

Twelve of the 72 was used in order to eliminate primacy and recency effects. The rest of the sixty pictures were divided into two groups, one of which was used in the phase of anxiety induction, and the other group was used in the memory tasks as distracters in the explicit memory task and controls in the implicit memory task. The pictures in two groups matched in content/theme, complexity and the amount of anxiety they induce. In order to assess the amount of anxiety each group of pictures provokes, a pilot study was conducted (for details see the Procedure). Turkish version of the State-Trait Anxiety Inventory (STAI) (Öner, 1977) (only the part for state anxiety) was administered to measure anxiety level (see Appendix H). The original of this scale was developed by Spielberger, Gorusch, and Lushene (1970). The scale consisted of two separate parts. There were 20 items in each section, one measuring temporary and situational anxiety level ("state anxiety") and the other measuring general and permanent anxiety level ("trait anxiety).

All pictures were presented via a computer in full screen mode. At the end of the session, a slideshow composed of 25 pictures of natural

landscape was displayed to eradicate the effect of mood manipulation procedure. Participants listened to Carabina 30-30, a traditional Mexican song, while watching the slideshow.

2.3 Procedure

2.3.1 Pilot Study

A pilot study was conducted for manipulation check. Thirty-six students at Bilgi University were accidentally assigned to one of the two conditions: (1) In the first condition participants were presented with the first group of pictures that were thought to be used for anxiety induction in the experimental phase of the study (30 pictures, which have pairs in the second group of pictures, plus 12 pictures, which were prepared against primacy and recency effect -6 of them were placed at the beginning and the remaining 6 were placed at the end of the 30 to-be-studied pictures); (2) In the second condition participants viewed the second group of pictures that are thought not to be presented in mood manipulation procedure but to be included in memory test in the experimental phase of the study (the rest 30 pictures plus the same 12 pictures used to eliminate primacy and recency effects). The two groups of pictures were hypothesized not to differ in their anxiety eliciting features.

Participants in all groups were, first, informed about the subject and the procedure of the pilot study and then they completed the anxiety scale. In the mood manipulation procedure, they viewed each picture for 5 sec. There was no interval between the pictures and thus the total duration of the

slideshow was 3.5 min. After the slideshow, they were given the anxiety scale for the second time.

At the end of the session, participants were presented with a slideshow of landscapes accompanied by a relaxing song, and debriefed.

2.3.2 Main Study

Participants were tested in individual sessions. After completing an informed consent form in accordance with approved Turkish Psychological Association (TPD) ethical guidelines (see Appendix A), they were provided with the BSI.

After completing the scale participants were randomly assigned to one of the four conditions: 1) Suppression condition followed by explicit memory task, 2) suppression condition followed by implicit memory task, 3) nonsuppression condition followed by explicit memory task, and 4) nonsuppression condition followed by implicit memory task.

In the sessions involving suppression, participants were presented with the anxiety evoking slideshow and asked to watch and understand the content of each photo. The slideshow consisted of 42 pictures (i.e. the first group of photos) with 5 sec view period for each. The complete duration of slideshow was 3.5 minutes.

Subjects were then provided with 3.5 min period during which they were asked to write their stream of consciousness. They were allowed to think anything during this period except the photos they have just viewed and related feelings to them. Moreover, they were asked to indicate

whenever the prohibited thoughts come to their mind. In order to encourage suppression of the anxiety provoking stimuli and prevent anticipation of a memory task, subjects were informed about a following arithmetical task (easy addition and subtraction problems which are not supposed to evoke anxiety-see Appendix I). The experimenter gave the following instructions which are similar to those in Wegner's study (1993, p. 1094):

> "During the next few minutes, you will simply be asked to write down your stream of consciousness, to indicate what is going through your mind. Measures have been taken to ensure your privacy and to guarantee confidentiality concerning your participation in this study. I don't know if you have done any stream of consciousness writing before, but basically this is free writing. It doesn't have to be grammatically correct; it can be words, phrases, or complete sentences. Just write down what you are thinking. Your report might include, but is not limited to, descriptions of images, ideas, memories, feelings, fantasies, plans, sensations, observations, daydreams, objects that catch your attention, and efforts to solve a problem. There are no restrictions, qualifications, conventions, or expectations. [However, there is only one exception: I want you not to think about the photos you have just viewed and any related feelings to them. If any such thought comes to your mind put a check mark in the margin of the paper for each time. After that, you will be asked a few of questions on basic arithmetical operations.] You may begin."

Following the suppression period subjects went through a 3.5 min-distracter period when they completed the personal information

questionnaire and the Turkish translated version of the EHI, and performed some mathematical problems. In order to enhance the effectiveness of distracter period the duration of the distracter period was extended to 11.5 min after the 58th participants of the study.

After the distracter period, participants were presented with either unexpected implicit or explicit memory tests. The explicit memory test included 30 new (serving as distracter) and 30 old pictures. All pictures were presented via a computer in a random order and subjects were required to recognize the pictures they have previously seen. After the 34th participant of explicit memory groups, recognition task was accompanied by a subsequent remember-know judgment. For each photo that they indicated as they saw before, they were to make a subsequent remember-know-guess decision. Before the experimental phase participants were informed about the definition of "remember", "know" and "guess" responses, and the difference among them according Eldridge, Sarfatti, and Knowlton (2002) (see Appendix J). After the instructions, subjects performed 5 training trials.

In the implicit memory task, subjects were required to study the same 60 pictures in the same order as in the explicit memory task. In this time, subjects' task was to rate the emotional valence of each picture on a Likert scale from 1 to 5 (1= neutral and 4= extremely negative) by pressing an appropriate key. Subject were told to put their left middle finger above the key 1, left index finger above the key 2, right index finger above the key 3, and right middle finger above the key 4. After pressing the key, the next photo appeared on the screen. The time from the appearance of each photo

to the subject's indication of his judgment (i.e. response time to each photo) was recorded.

In the nonsuppression conditions, subjects completed the same steps as in the suppression conditions, except that they did not receive suppression instruction. Instead, they were allowed to think anything when they are reporting their stream of consciousness for 3.5 min following the presentation of the slideshow. The instruction in this condition was like the following (Wegner, 1993, p. 1094):

> "During the next few minutes, you will simply be asked to write down your stream of consciousness, to indicate what is going through your mind. Measures have been taken to ensure your privacy and to guarantee confidentiality concerning your participation in this study. I don't know if you have done any stream of consciousness writing before, but basically this is free writing. It doesn't have to be grammatically correct; it can be words, phrases, or complete sentences. Just write down what you are thinking. Your report might include, but is not limited to, descriptions of images, ideas, memories, feelings, fantasies, plans, sensations, observations, daydreams, objects that catch your attention, and efforts to solve a problem. There are no restrictions, qualifications, conventions, or expectations. [After that, you will be asked a few of questions on basic arithmetical operations.] You may begin."

At the end of the session, participants in the suppression groups (suppression followed by explicit task, and suppression followed by implicit task) were asked to rate how much they have tried to suppress their thoughts

and how much they succeed suppression on a Likert scale from 0 to 100, separately (see Appendix K). Additionally, any strategies for not thinking about thoughts related to the photos during the suppression period were assessed.

Following the completion of the experiment, participants watched the slideshow of landscape pictures accompanied by a relaxing song, and debriefed.

Chapter 3: Results

3.1 Pilot Study

In order to check the effectiveness of the study photos in making individuals anxious a 2 x 2 mixed model ANOVA was applied to participants' scores on the State Anxiety Inventory. The group of photos (to-be-suppressed photos vs. distracter/control photos presented during the memory task) served as between-subjects factor, and the session at which the anxiety score was obtained (before vs. after slideshow) served as within-subjects factor. There was a significant difference in anxiety scores from first session to second session, $F(1,34)= 70.932$, $p<.001$, partial $\acute{\eta}^2=.676$, observed power=1.000. After participants watched the slide of the photos, they became more anxious (before anxiety induction, $M= 40.31$, $SD= 11.553$; after anxiety induction $M= 54.97$, $SD= 10.421$). Moreover, as expected, the first and the second groups of photos were equally effective in inducing anxiety, $F(1,34)= .072$, $p=.790$, partial $\acute{\eta}^2=.002$. Similarly, psychologists found the second group of photos ($M= 43.50$, $SD=8.080$) as negative as the first group of photos ($M= 43.53$, $SD= 6.107$), $t(29)= -.024$, $p=.981$.

3.2 Main Study

3.2.1 Descriptive Statistics

Based on the results of the Kolmogorov-Smirnov tests of the distributions of scores, all data in the form of measurements, except the degree of handedness, and the accuracy of guess responses, had normal distributions.

Changing the duration of distracter period from 3 minutes to 12 minutes did not moderate the effect of suppression on recognition or implicit memory performance (for recognition task, p=.314 when only the cases taking 12 min. distracter period were included, and p=.266 when all cases were included; for implicit task, p=.403 and p=.341 respectively). Accordingly, all cases were entered into the data analyses.

3.2.2 Suppression and Memory

3.2.2.1 Explicit Memory

Mean (and standard deviation) for accuracy of recognition was 23.57 (3.602), raw scores of remember responses was 16.92 (7.149), raw scores of know responses was 8.21 (6.261), raw scores of guess responses was 2.13 (1.932), accurate scores of remember responses was 16.47 (7.086), accuracy scores of know responses was 7.32 (6.290), and accuracy of guess responses was .58 (1.622).

Recognition

For analysis of the relationship between suppression and explicit memory initial analysis was conducted on recognition performance. The

accuracy of recognition responses was estimated by subtracting the total number of incorrect responses to new photos (false alarms) from the total number of correct responses to old photos (hits) in order to eliminate the possibility of response bias (tendency to respond indiscriminately to all items). Accuracy of recognition was high for the sample overall (M=23.57, SD=3.602). Independent samples of t-tests yielded no difference between suppression and nonsuppression groups in the accuracy of recognition scores, $t(73)$= .561, p= .288 (M=23.281, SD=3.81, and M=23.34, SD=3.42, respectively).

Engaging in suppression per se may not produce adverse effects on memory, rather how much individuals put effort for suppression and/or how much they succeed to suppress may lead to impairments in memory processes. In the second step of each analysis for the memory performances, this view was tested.

Suppression success and suppression effort was assessed via a scale ranging from 0 to 100. For statistical advantage, those data were reduced into two categories separately. The median score of each variable was used as the cutoff point. Scores from lowest to 50 were classified as “low success” or “low effort”, and those from 51 to 100 were classified as “high success” or “high effort”.

The effect of suppression success on the accuracy of recognition responses was calculated via the Mann-Whitney test. The results indicated that individuals who were more successful in suppressing the thoughts about the anxiety related photos obtained similar accuracy scores to those who

were less successful, z= .977, p= .164. Likewise, there was no significant difference in accuracy rates between individuals with high and low suppression effort, z= .888, p=.188. On the other hand, as Figure 1 shows, individuals who succeeded to suppress by using high effort showed marginally poorer recognition performance than those who were not successful even though they tried hard, z= 1,583, p=.056. Furthermore, when people did not display much effort to suppress, their recognition performance was not affected by their suppression success level, z= .397, p=.34.

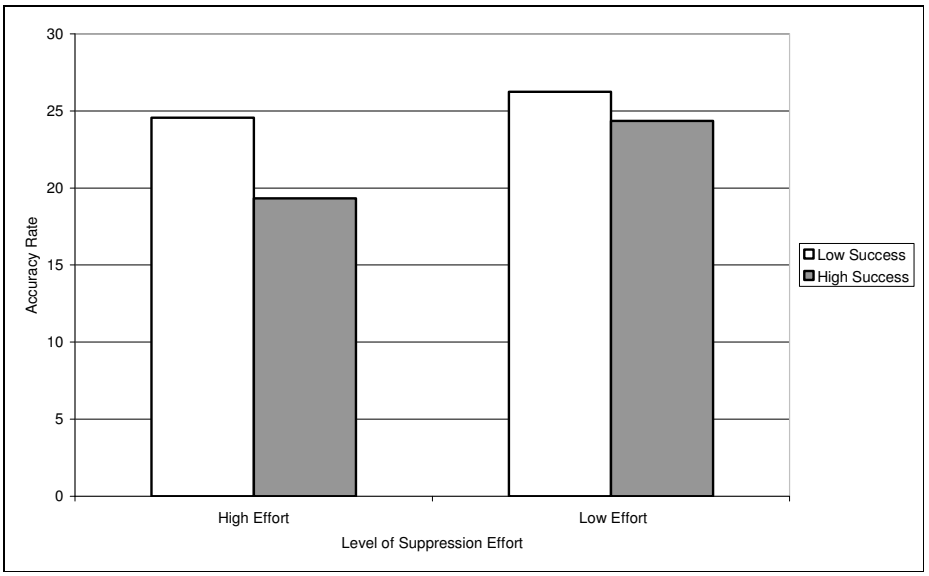


Figure 1. Means of accuracy scores as a function of the levels of suppression effort and suppression success.

In order to assess rehearsal effect on recognition performance a Pearson correlation test was conducted. The results indicated a significantly positive correlation between the number of intrusions and the accuracy rate,

r=.317, p<.05. As the number of intrusions for to-be-suppressed thoughts increased, so does the number of correctly recognized items.

Remember-Know-Guess Judgments

For exploring the effect of the suppression instruction on remember-know-guess responses, means (and standard deviations) are depicted in Table 1.

Table 1. *Means (standard deviations) for number of remember, know and guess responses as a function of test measure and suppression instruction*

Test type and measure		Suppression (n=27)	Nonsuppression (n=26)
Raw number of responses	Remember	17.33 (7.47)	16.5 (6.92)
	Know	7.78 (5.56)	8.65 (6.99)
	Guess	1.59 (1,6)	2.69 (2,11)
Corrected scores	Remember	16.59 (7.3)	16.35 (7.0)
	Know	6.70 (5.54)	7.96 (7.04)
	Guess	.85 (1.35)	.31 (1.85)

In order to examine the relationship between suppression condition and the absolute number of remember, know and guess responses a 2 (suppression vs. nonsuppression) X 3 (response type) mixed model ANOVA with response type as the within-subjects factor, and group as the between-subjects factor was conducted. In the previous analyses

participants' total score on SA-45 was included in all analyses on explicit memory performances as covariate. However, the effect of the covariate factor was not significant, thus SA-45 scores was not included in final analyses as covariate. Results revealed a main effect of response type, $F(2,102)=63.939$, $p=<.001$, partial $\acute{\eta}^2= .556$, observed power=1.00. According to post hoc analysis using the Bonferroni adjustment, participants were more likely to give 'remember' response ($M=16.92$, $SD=7.149$) than 'know' $M=8.21$, $SD= 6.261$) and 'guess' ($M=2.13$, $SD=1.932$) responses, and they were more likely to give 'know' response than 'guess' response regardless of receiving suppression instruction or accuracy of their responses. Neither main effect of suppression instruction, $F(1,51)=1.512$, $p= .22$, partial $\acute{\eta}^2= .029$, nor interaction between response type and suppression was observed, $F(2,102)=.324$, $p= .724$, partial $\acute{\eta}^2= .006$.

For exploring the effects of suppression success and suppression effort on the absolute number of remember-know-guess responses the Mann-Whitney tests were applied. Due to the statistical restrictions of the nonparametric tests the difference of remember responses from total number of know and guess responses was included in data analyses (recollection/familiarity =R – [G+K]). This decision was based on the knowledge that 'guess' responses, like 'know' responses, depends on familiarity process. Thus, these two kinds of judgment are not essentially different (Gardiner, Ramponi, & Richardson-Klavehn, 1999).

The results revealed that neither suppression effort nor suppression success induced any impacts on the amount of difference between

'remember' and 'know+guess' responses (z= .782, p=.217; and z= .923, p=.128, respectively). While combination effects of suppression success and suppression effort did not generate a significant difference (with high suppression effort the effect of suppression success: z= 1.392, p=.082; with low suppression effort: z= .327, p=.372), the lowest raw remember rate was observed when both suppression effort and suppression success were high. That is, participants tended to give 'know' or 'guess' responses (M=14.33, SD=8.185) slightly more frequently than 'remember' responses (M=12, SD=12) when they showed high suppression effort and high suppression success. Under all the other conditions (low effort-high success; high effort-low success; and low effort-low success) individuals were more likely to judge as remember than as 'know+guess'. The results of the Mann-Whitney tests are summarized in Table 2 and Figure 2.

Table 2. *Means (standard deviations) for absolute number of remember and know+guess responses as a function of test measure and suppression instruction.*

	High Effort		Low Effort	
Response Type	Low Success	High Success	Low Success	High Success
Remember	19.56 (6.784)	12 (12)	15.5 (5.655)	17.64 (7.646)
Know+Guess	6.11 (4.859)	14.00 (8.185)	11.25 (3.862)	10.09 (5.855)

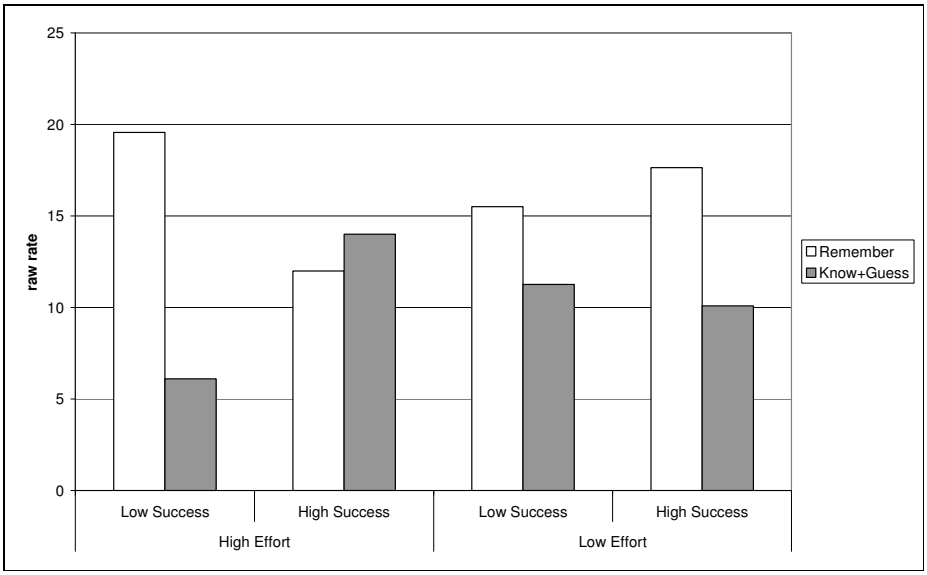


Figure 2. Means for 'remember' and 'know+guess' difference in raw scores as a function of the levels of suppression effort and suppression success.

The accuracy of remember-know-guess responses was separately calculated by subtracting total number of 'remember' or 'know' or 'guess' false alarms from total number of 'remember' or 'know' or 'guess' hits. Analysis of corrected scores using a 2 (suppression vs. nonsuppression) X 3 (response type) mixed model ANOVA replicated the previous finding presented above. There was a significant main effect of response type, $F(2,102)=75.242$, $p=<.01$, partial $\acute{\eta}^2= .001$, observed power=1.00. Thus, participants significantly responded as 'remember'. There was neither main effect of suppression instruction, $F(1,51)=.231$, $p= .633$, partial $\acute{\eta}^2= .005$, nor interaction between response type and suppression condition, $F(2,102)=.276$, $p= .759$, partial $\acute{\eta}^2= .005$.

Further analyses for the effects of suppression effort and suppression success on the accuracy of 'remember'-'know+guess' responses were

conducted via the Mann-Whitney tests. The amount of difference between 'remember' and 'know+guess' responses was not influenced by the level of effort paid for suppression, z= .981, p=.163. Similarly, no suppression success effect was detected, z= .610, p=.271. While good suppressors and bad suppressors did not display an obvious difference in terms of the accurate 'remember'-'know+guess' discrepancy under low level of suppression effort, under high level of suppression effort the discrepancy between 'remember' and 'know+guess' responses was lower for good suppressors as compared to poor suppressors (see Table 3 and Figure 3 for means). However these analyses did not reach the significance level (with high suppression effort the effect of suppression success: z= .653, p=.257; and that with low suppression effort: z= .655, p=.256)

Table 3. *Means (standard deviations) for accuracy scores of remember and know+guess responses as a function of test measure and suppression instruction.*

	High Effort		Low Effort	
Response Type	Low Success	High Success	Low Success	High Success
Remember	18.89 (7.373)	12.00 (12)	15.5 (4.655)	16.36 (6.932)
Know+Guess	5.66 (4.242)	7,33 (11)	10.75 (4.878)	8.00 (5.366)

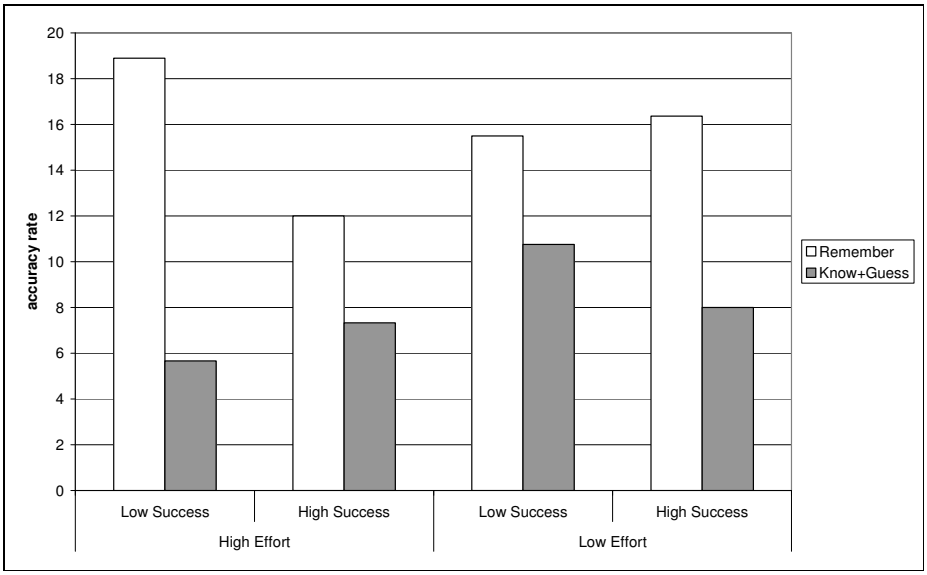


Figure 3. Means of remember-know+guess accuracy scores as a function of the levels of suppression effort and suppression success.

3.2.2.2 Implicit Memory

Implicit memory performance was considered as the difference in response times for assigning an emotional valence to old and new photos. As expected for an indication of implicit memory, the response times to new photos (*M*= 1903.23, *SD*=670.75) were significantly slower than those to old photos (*M*=2143.49, *SD*=776.628) according to the results of the paired-samples t-tests, $t(64)= -8.078$, $p<.000$. Thus, the implicit memory task was successful.

In order to test the effect of suppression on implicit memory performance first an independent samples t-test was applied. In the suppression condition the difference between response times to old and new pictures was slightly more obvious than that in the nonsuppression condition (*M*=270.14 ms, *SD*= 240.066, and *M*=213.02 ms, *SD*=239.776,

respectively). However, such difference was not statistically significant, $t(63)=.959$, $p=.17$ (see Figure 4).

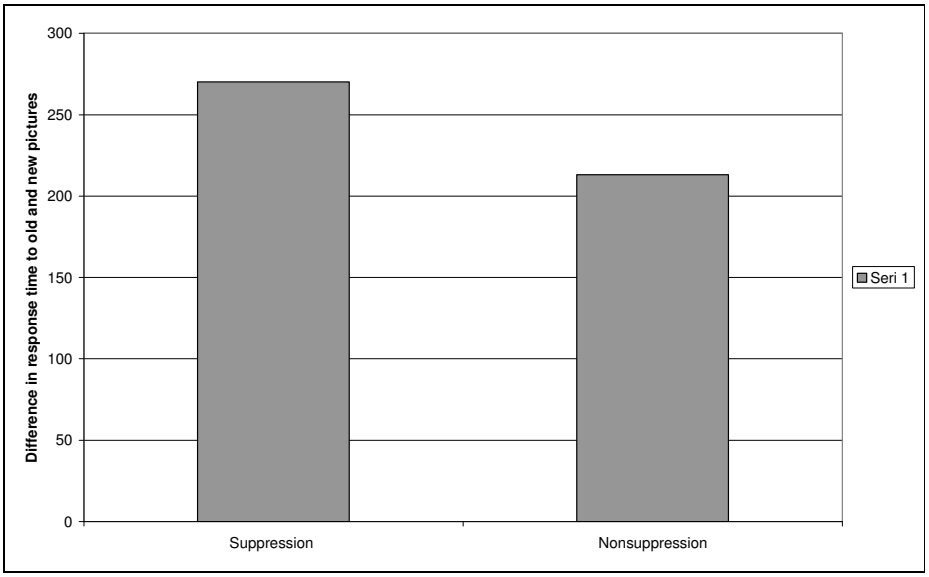


Figure 4. Means of differences in response times to old and new pictures under suppression and nonsuppression conditions..

Second, a 2X2 mixed model ANOVA with response time to new and old photos as the within-subjects factor, and presence of the suppression instruction as the between-subjects factors was conducted. A main effect of response time to new and old photos was identified, $F(1,63)= 65.756$, $p<001$, partial $\acute{\eta}^2=.511$. Presence of the suppression instruction did not induce a main effect, $F(1,63)= 1.591$, $p=212$, partial $\acute{\eta}^2=.025$. No interaction was found, $F(1,63)= .919$, $p=.314$, partial $\acute{\eta}^2=.014$.

For the further analysis measuring the effect of suppression effort and suppression success on implicit memory performance (the difference between response times to old and new pictures) four separate the Mann-Whitney tests were conducted. Neither suppression effort nor suppression

success yielded any effects on implicit memory performance; z= .499, p=.31, and z= 1.253, p=.11, respectively. Moreover, when individuals engaged in suppression with high effort, they displayed similar implicit memory performance regardless of how much they succeeded to suppress, z= .092, p=.463. Nevertheless, good suppressors demonstrated significantly lower performance on implicit memory than poor suppressors when they did not try hard to suppress, z= 1,709, p<.05. The results of Mann-Whitney tests are depicted in Figure 5.

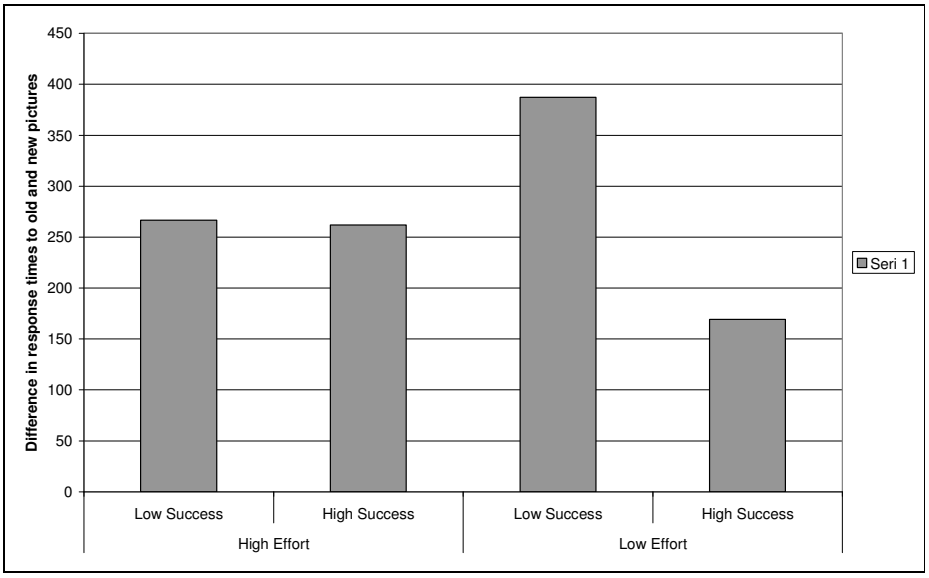


Figure 5. Means of differences in response times to old and new pictures as a function of suppression effort and suppression success.

3.2.3 Suppression, Handedness and Memory

The handedness scores of the participants were ranged from 0 to 100. The mean score for the sample on the EHI was 76.86 (25.44) and median was 80. In order to identify participants as either mixed or strongly

right-handed median was used as the cutoff point. Scores from lowest to 80 were classified as mixed-handed, and those from 81 to 100 were classified as strongly right-handed.

3.2.3.1 Explicit Memory

Recognition

Means and standard deviations for accuracy scores in relation to the presence of suppression instruction and the degree of handedness are presented in Table 4. A two-way ANOVA was performed on accuracy scores, where suppression condition (suppress vs. no suppress) and handedness (mixed vs. strong) were used as independent variables. Analyses demonstrated that the accuracy of recognition did not change as a function of suppression condition, $F(1,71)=.324$, $p= .571$, partial $\acute{\eta}^2= .005$, or the degree of handedness, $F(1,71)=.131$, $p= .719$, partial $\acute{\eta}^2= .002$. There was no evidence of a significant two-factor interaction, $F(1,71)=.003$ $p=.959$, partial $\acute{\eta}^2= .000$.

Table 4. *Means (standard deviations) for accuracy scores as a function of handedness and suppression condition.*

Suppression		Nonsuppression	
Mixed-handed (n=20)	Strong-handed (n=17)	Mixed-handed (n=19)	Strong-handed (n=19)
23.65 (3.746)	24.00 (4.000)	23.21 (3.706)	23.47 (3.204)

Further analyses were conducted on suppression success and suppression effort. No significant interaction was found between

suppression effort and strength of handedness for accuracy scores, $F(1,33)=.015$, $p=.904$, partial $\acute{\eta}^2= .000$. On the other hand, according to the results of the Mann-Whitney tests while successful suppression did not generate a significant difference in accuracy rates for strongly right-handed individuals, $z= .467$, $p=.32$, mixed handed participants displayed a significantly lower performance when they successfully suppressed unwanted thoughts about the photos $z= 2.064$, $p<.05$. In other words, mixed-handed participants recognized more accurately than strongly right-handed participants when they did not suppress successfully, $z=1.945$, $p<.05$; but under the condition of high suppression success strongly right handed people were slightly better than those with mixed handedness (z= .639, p= .261). This finding is depicted in Figure 6.

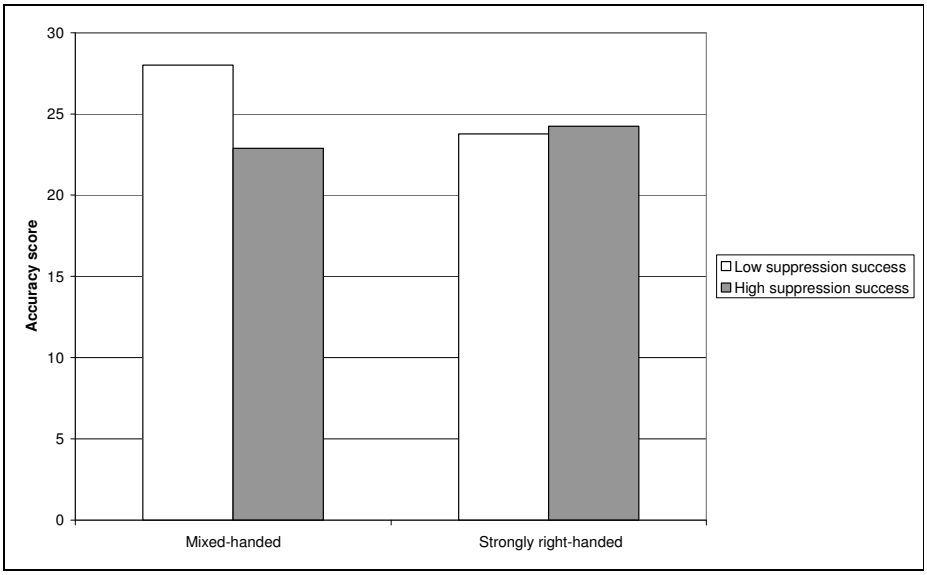


Figure 6. Means for accuracy scores as a function of strength of handedness and level of suppression success.

Remember-Know-Guess Judgments

Means and standard deviations for accuracy scores of remember-know-guess judgments as a function of handedness and suppression condition are presented in Table 5.

A 2 x 2x 3 repeated measures ANOVA was applied in order to test the combined effect of handedness and the suppression instruction. In this analysis, response type (remember-know-guess) served as within-subjects factor, and suppression condition (suppression vs. nonsuppression) and strength of handedness (mixed vs. strong) served as between-subjects factors. Mixed-handed and strongly right-handed participants did not differ in the accuracy of remember-know-guess judgments, $F(2,98)=.006$, $p=.994$, partial $\acute{\eta}^2= .000$. Moreover, no interaction between suppression condition and strength of handedness for the accuracy of remember-know-guess responses was observed, $F(2,98)=1.667$, $p=.194$, partial $\acute{\eta}^2= .033$. Nevertheless, the memory strength of mixed-handed individuals was more likely to be negatively affected by the suppression instruction than that of strongly right-handed individuals. That is, a slight, but not significant, decrease in the number of 'remember' responses and a slight increase in 'know' and 'guess' responses was observed when mixed handed participants were given suppression instruction as compared to those who were not. For strongly right-handed individual a reverse condition was observed.

Table 5. *Means (standard deviations) for accuracy of remember, know and guess responses as a function of strength of handedness and suppression condition.*

	Strength of handedness	Response type		
		Remember	Know	Guess
Mixed-handed	Suppression (n=14)	15.71 (7.087)	8.00 (5.831)	.64 (1.499)
	Nonsuppression (n=14)	17.43 (6.618)	6.79 (6.589)	.50 (2.279)
Strongly right-handed	Suppression (n=13)	17.54 (7.688)	5.31 (5.056)	1.08 (1.188)
	Nonsuppression (n=12)	15.08 (7.513)	9.33 (7.584)	.08 (1.240)

Likewise, there was no interaction either between suppression effort and handedness or suppression success and handedness. Mixed-handed participants did not show a significantly different performance from strongly right handed participants on the basis of suppression success or suppression effort. Under the condition of low suppression success the Mann-Whitney tests on handedness and remember-know difference yielded z= .153, p=.438, and analysis with high suppression success condition revealed z= .427, p=.334. For analysis conducted when suppression effort was low, the result was z= .353, p=.361; and when suppression effort was high, z= .164, p=.435 was obtained.

3.2.3.2 Implicit Memory

Means and standard deviations for response time (in milliseconds) for rating emotional valence of new and old photos as a function of strength

of handedness and suppression condition are presented in Table 6. A two-way MANOVA was conducted in order to measure the impact of suppression on implicit memory performance of mixed handed individuals as compared to strongly right handed individuals. In this analysis, response time to new and old photos in rating emotional valence served as within-subjects factor, and strength of handedness and suppression condition served as between-subjects factors. There was no effect of the strength of handedness on implicit memory performance, $F(1,61)= .616$, $p= .435$, partial $\acute{\eta}^2=.01$. Both mixed handed and strongly right handed participants responded more slowly to new photos compared to old photos. Similarly, when suppression condition was included in this analysis, no interaction was obtained, $F(1,61)= .586$, $p= .447$, partial $\acute{\eta}^2=.01$. That is, mixed-handed individuals were as fast as strongly right-handed individuals in responding to old and new photos under both suppression and nonsuppression condition. However, suppression instruction had a slightly greater impact on implicit memory performance for mixed handed individuals than strongly right handed individuals. When mixed handed participants received the suppression instruction, their implicit memory performance was slightly, but not significantly enhanced.

Table 6. *Means (standard deviations) for response time (in milliseconds) for rating emotional valance of new and old photos as a function of strength of handedness and suppression condition.*

Handedness	Suppression condition	RT old photos (ms)	RT new photos (ms)
Mixed-handed	Suppression (n=15)	1798,31 (606,775)	2117,48 (742,978)
	Nonsuppression (n=13)	1964,44 (858,319)	2178,20 (909,521)
Strongly right-handed	Suppression (n=16)	1746,49 (361,931)	1970,99 (490,967)
	Nonsuppression (n=21)	2059,71 (765,279)	2272,26 (907,761)

Further analysis measuring the effect of suppression effort and suppression success in relation to the strength of handedness on implicit memory performance (the difference between response times to old and new pictures) was conducted via the Mann-Whitney tests. The difference in response times to new and old photos did not vary significantly between mixed-handedness and strong-handedness either when suppression success was low or when it was high, z= 1.601, p=.055 (comparison of mixed and strong handedness under low suppression success), and z= .853, p=.426 (comparison of mixed and strong handedness under high suppression success). Likewise, no effect of suppression effort in relation to handedness was observed, z= .333, p=.369 (comparison of mixed and strong handedness under low suppression effort), and z= 1.416, p=.078 (comparison of mixed and strong handedness under high suppression effort).

3.2.4 Moderating Factors for Negativity Perception

Participants who received the suppression instruction found to-be-suppressed photos slightly less negative (*M*=89.71, *SD*=14.985) than those who were allowed to think about these anxiety-related photos during the free writing period (M=95.15, SD=14.196). However, an independent samples t-test indicated no group difference in emotional valence ratings, $t(63)=1.505$, $p=.069$.

For analyzing the effects of suppression success and suppression effort, Figure 7 reveals a tendency to rate old pictures as more negative when participants successfully suppressed the thoughts about these photos as compared to when they did not. The increase in the emotional valence of the old photos was even more obvious when high successful suppression was accompanied by high suppression effort. On the other the results of the Mann-Whitney tests indicated neither the effect of suppression success on the rates of emotional valence of old photos, $z= .528$, $p=.299$; nor the effect of suppression effort, $z= .666$, $p=.252$.

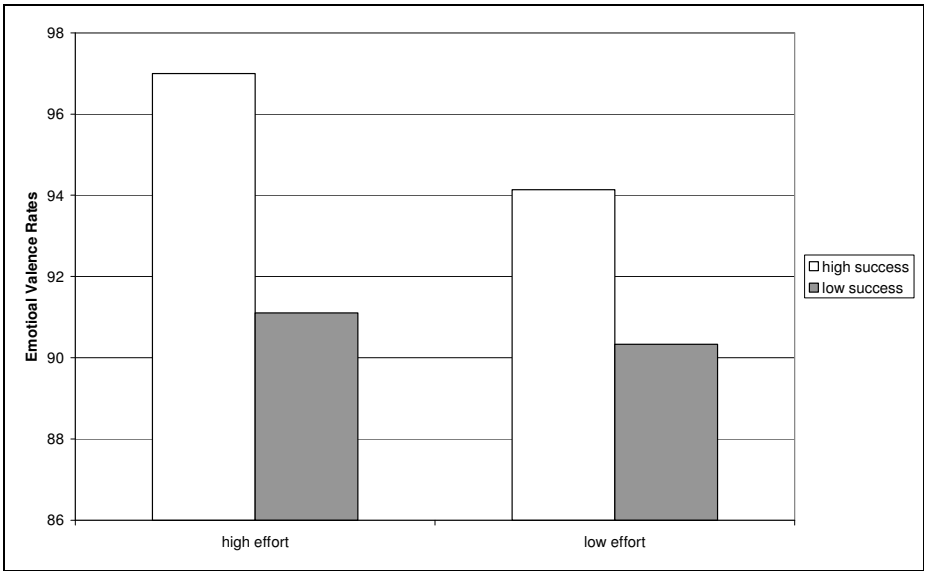


Figure 7. Means for the total emotional valence ratio to old and new pictures as a function of the levels of suppression effort and suppression success.

For analysis of the effect of degree of handedness an independent samples t-tests was performed on the total rate of emotional valence for each subject. The results indicated a group difference in perceived negativity level of pictures, $t(63)= 2.128$, $p<.05$. Mixed-handed subjects found the experimental pictures (old and new) less negative (M=179.46, SD=34.584) than strongly right-handed subjects (M=194.68, SD=22.969) (see Figure 8).

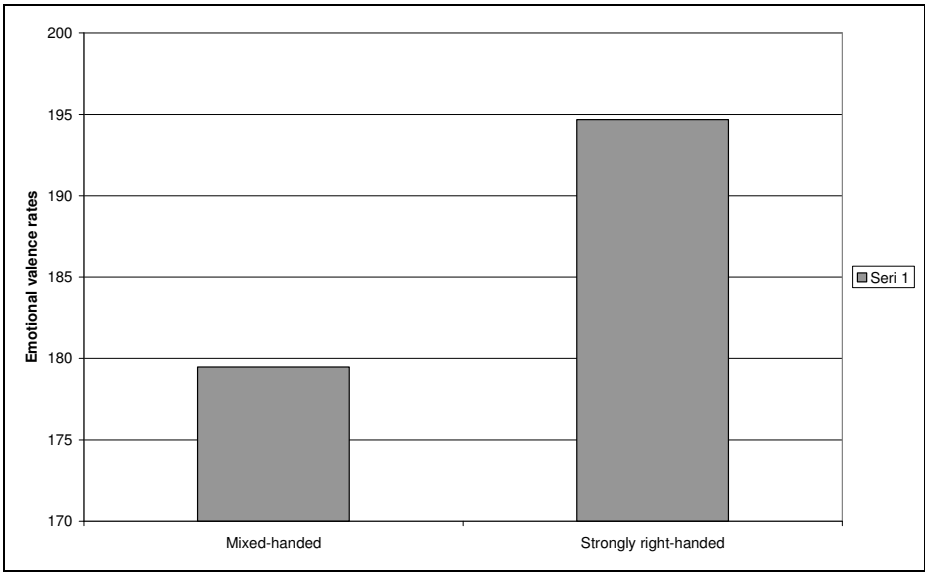


Figure 8. Means for the total rate of emotional valence for pictures as a function of degree of handedness.

Chapter 4: Discussion

In everyday life, we face many stressful situations, from mild to severe, and we somehow maintain our life with the help of the strategies that we insert to regulate our negative emotions. Some of these strategies operate out of awareness, and some of them are the result of our conscious attempt. Although emotion regulation strategies protect us from being overwhelmed by emotions provoked by the adverse stimuli, they may have some costs in the long-run. Thought suppression, a conscious attempt to refuse to think about or pay attention to the target aversive stimuli, is one of the common ways of coping with unbearable feelings. The present study was conducted to examine the effect of suppression of visual emotional stimuli on different types of memory systems. Additionally, it was aimed to explore a potential relation of thought suppression to decreased hemispheric integration. Finally, moderating factors, such as degree of handedness and suppression, in perceiving distress were investigated.

Along with the first aim of the study, a detrimental effect of thought suppression on explicit memory performance, but not on implicit memory performance was hypothesized. More specifically, the first hypothesis of the study was that subjects who received the suppression instruction would recognize to-be suppressed photos less accurately than those who were allowed think anything. However, this was not the case. The recognition

responses of suppression group and nonsuppression group were equally accurate. This may be because the emotional stimuli were so demanding that subjects might have had difficulties to suppress appropriately (Rachman, 1981; Depue, et al., 2006). This is compatible with Wegner's (1987; 1992) theory of double processes in suppression. Operator process may have been impeded due to the demanding nature of the target, but intact monitoring process may have provided opportunity for rehearsal. However, one can be more confident with this conclusion if the results indicated a superior performance after suppression. On the other hand it can be concluded that no difference in recognition performance after suppression may have resulted from the variation in subjects' ability to suppress.

In order to take into account potential suppression failure, secondary analyses were conducted on the level of effort individuals put for suppression and the level of their success of suppression. According to the results, suppression of emotional stimuli led to impairment in recognition memory only when the individual tried hard to suppress the aversive target and additionally when s/he came up with success. Although this finding had a marginal statistical significance, it has important implications for the underlying process of thought suppression. This finding suggests that the investment of cognitive resources for successful avoidance from unwanted thoughts leads to the disruption of rehearsal opportunity. Along with the finding indicating a positive correlation between the number of intrusion and recognition performance, the lack of rehearsal resulting from depleted cognitive resources is suggested as underlying the detrimental effect of

thought suppression. Therefore, these findings provide support for resource depletion explanation (Wegner et al., 1992; Klein & Bratton, 2007).

The second hypothesis of the study was related to examining the effect of thought suppression on retrieval of details associated with the visual information. It was expected that being involved in thought suppression would disrupt recollection based recognition process more than familiarity based one. The study failed to indicate a mere effect of suppression on different processes of visual recognition memory. Likewise, analysis of suppression effort and suppression success revealed no significant results. However, it is important to note that when high suppression effort interacted with suppression success participants' recollection performance slightly decreased. However, there was no considerable statistical significance.

This failure in providing evidence for recollection disruption is not consistent with the findings of Wegner's (1996) study that found a disruption in the recall of the sequence of the visual stimulus. Although different forms of memory were subjected to suppression effect, the explanation for expected detrimental effect depended on the resource depletion theory. Similar to serial recall, retrieval of associated details requires a deep, cognitively expensive process (Yonelinas, 2002). However, these two memory systems may rely on different mechanism (Yonelinas, 2002). For instance recollection mainly involves a holistic, simultaneous process, whereas sequential processes depend on the analysis of small components of the target material.

The third hypothesis of the study related to its first aim suggested that there would not be impairment in implicit memory performance following suppression. The result was in the line with this expectation. Suppression group tended to display a slight enhancement in implicit memory performance relative to nonsuppression group. Furthermore, while recognition memory of good suppressors suffers more than those of poor suppressors under effortful suppression, implicit performance of good suppressors was worse than poor suppressors under low suppression effort. Therefore, the decrease in implicit memory performance occurred only when individuals easily managed to avoid the target thoughts. As a stimulus is more personally relevant it is harder to be avoided (Klein & Bratton, 2007). Thus, it can be suggested that demanding targets such as, personally relevant materials, even when they suppressed successfully, are more resistant to extinguish from implicit mechanisms. However, with high effort and successful suppression their conscious representations abate.

The second aim of the study was to provide information about potential neurological mechanisms underling thought suppression. Firstly, it was hypothesized that mixed handedness, which is thought to be an indication of hemispheric integration, would be associated with a greater decrease in recognition performance after suppression than strong handedness. As indicated above, suppression per se was not again capable of inducing any effect on memory systems. The effects of suppression effort and suppression success on the accuracy of recognition responses were examined by independent analyses. Mixed-handed and strongly right-

handed individuals displayed similar recognition performance regardless of how much effort they expended. On the other hand, while in the absence of a successful suppression mixed-handed participants recognized more accurately than strongly-right handed participants. This finding is similar to those of Parker et al. (2008) but not to those of Propper and Christman (2004). Although the measure of hemispheric integration use in this study was the same as that used in Propper and Christman's (2008) study, rather than Parker's (bilateral eye movements procedure), the results indicated a reverse pattern. This is probably because the variation in suppression group in terms of suppression success. Inclusion of only participants who successfully suppressed may reveal different conclusions. On the other hand, imposition of bilateral eye movements may be more influential for the retrieval of verbal stimuli. Being mixed handed may be as effective as engaging in bilateral eye movements in recognition of visual stimuli. In addition to the demonstrations of those studies, this study provided evidence for an improved memory performance associated with mixed handedness for emotional information. Moreover, the recognition performance of mixed-handed participants was influenced by successful suppression to a greater extent than that of strongly-right handed participants. As noted in the introduction, episodic memory involves the functions of two hemispheres. It can therefore be argued that successful thought suppression may produce explicit memory deficit through preventing "the interaction of right hemisphere retrieval process with memory traces encoded in the left hemisphere" (Parker et al., 2008, p. 136).

Second hypothesis deriving from the second purpose of the study indicated a considerable decrease in recollection-based recognition responses as compared to those of familiarity-based in mixed-handedness after suppression. On the other hand, strongly-right handed individuals were expected to be less affected by suppression instruction in terms of recollection and familiarity performances. Along with the previous findings of this study, receiving suppression instruction did not induce any differential impacts on different types of recognition memory. It can only be noted that a slight decrease in recollection that was accompanied by a slight increase in familiarity was observed in suppression group, and a reverse phenomenon was observed in suppression condition. Unexpectedly, analysis of suppression effort and suppression success did not yield any differences between familiarity and recollection performances as a function of the degree of handedness. Nonetheless, the present study also failed to find out well developed memory skills (i.e. retrieving much more associated details) related to mixed handedness in contrast to previous studies (Parker et al. 2008; Proper & Christmant, 2004). Moreover, recall performance is more susceptible to either impairment or enhancement manipulations (e.g. Bjork, & Bjork, 2003). Because recollection is similar to recall process, this finding also contradicts with the previous result of the present study that mixed-handedness was associated with better recognition performance when suppression attempt failed. Therefore, it can be concluded that this study may have failed to allow participants to make valid remember-know judgment. The reasons for such failure will be discussed later.

The third expectation associated with the second goal of the study was that suppression would not influence implicit memory performance of either mixed-handed participants or strongly right-handed participants. As expected, mixed-handed and strongly right-handed participants displayed similar performance, even under suppression condition. However, because an expected effect of mere the suppression instruction was not demonstrated in previous findings of the study, this result does not have important implications. An interesting picture which is worth to be mentioned is that the most enhanced implicit memory performance was detected when mixed-handed individuals received the suppression instruction. This is interesting because for mixed-handed people thought suppression (more accurately successful thought suppression) was associated with a significant impairment in explicit memory, but with a relative enhancement in implicit memory. However analyses regarding suppression effort and suppression success reveal more reliable indications. Once again, invulnerability of implicit memory across all conditions was proved. Equal implicit memory performances were obtained by mixed and strongly right handed participants even though they exhibit different amount of effort to suppress. Similarly, regardless of the amount of their success in suppression, both group attained similar implicit scores.

The final aim of the study was to examine the emotional experiences in the face of the aversive stimuli as a function of thought suppression and degree of handedness. It was suggested that thought suppression may moderate the immediate emotional responses, but would be ineffective in

long-term regulation of emotional experiences. Long-term consequences of thought suppression are beyond the scope of this study. For more immediate consequences of thought suppression in terms of regulating emotional experiences, findings reveal that regardless of the presence of suppression instruction or the amount of suppression effort or suppression success all participants found the target stimuli highly distressing. Individuals who engaged in suppression attempt reported slightly lower negative connotations for the targets. As demonstrated by previous studies on ironic process of suppression (e.g. Harvey, & Bryant, 1998), it can therefore be claimed that thought suppression is not an efficient way of regulating the way we perceive the external world.

An expected association between mixed handedness and lower level of distress was evidenced by the results of the study. As pointed out in the Introduction, more complicated mental functions involve collaboration of different structures of the brain (e.g. Gallagher, & Frith, (2003). Emotion regulation, especially more developed strategies, has been suggested to be related to integrative activities in the prefrontal cortex and the amygdala (cortical and subcortical integration) (Ochsner & Gross, 2005). Depending on the findings of the present study, it can also be suggested that emotion regulation may involve bilateral activation in the brain. This proposal should be investigated by future studies which include neuroimagining techniques, experimental manipulations or split-brain patients.

The result of the current study contributes to understanding the underlying cause of paradoxical findings of previous studies regarding

thought suppression and memory processes. As demonstrated in this study providing suppression instruction may not induce a consistent suppression for all study subjects. Likewise, measuring the attempt for suppression is not a sufficient way to check suppression manipulation. In this study both suppression effort and suppression success were assessed in order to ensure that suppression manipulation is successful. However, there were four different responses to the suppression instruction: 1) those who tried hard for suppression and managed to suppress, 2) those who tried hard but failed to suppress, 3) those who did not tried so much and failed to suppress, and 4) those who did not try so much for successful suppression. Such variation in suppression group may account for the variations in the findings of different thought suppression studies. It was found that experimental categorization on the basis of suppression instruction was not capable of providing evidence for suppression effect. Rather, suppression effect on memory processes was detected when assigning groups on the basis of the level of suppression effort and suppression success. Additionally, variations in experimental procedures may moderate the amount of cognitive effort, and/or motivation for successfully suppressing (e.g. Klein & Bratton, 2007)

Based on the findings, it can be suggested that the effect of thought suppression on explicit memory processes can primarily be explained by inability to rehearse under a demanding cognitive load. In order to remove conscious trace of an unwanted thought, people should have motivation for avoiding from them. In real life we generally refuse to think about materials that provoke subjectively negative emotions. Therefore, as the personal

relevance of a stimulus increases, so does the motivation to forget. However, highly relevant information is more resistant to be diminished, and more likely to intrude into consciousness. Therefore, prevention of such intrusion demands a considerable amount of cognitive resources, which is also necessary to carry other ongoing cognitive tasks. First possibility is that engaging in such a demanding task may deplete the resources necessary for rehearsal. In addition, successful suppression usually involves turning attention to the distracter thoughts. Investment of attentional resources other than the target thought prevents opportunity for rehearsal. (e.g. Macrae et al., 1997).

Alternatively, there might be some deficits in retrieval of suppressed items related to the lack of rehearsal. No decline in implicit memory performance of participants with high suppression effort and high suppression success, instead a minor increase following suppression, may suggest that suppressed thoughts are probably encoded properly, however their retrieval is impeded. This argument contradicts with the proposal of Fleck et al. (2001). They suggested a deficit in encoding process as a cause of forgetting induced by the forget instruction. The discrepancy between two studies may be related to methodological differences. In Fleck and his colleagues' study (2001), selective encoding of to-be-remembered items may have inhibited the encoding of to-be forgotten items. A related decline in their participants' implicit memory performance supports this view. On the other hand, in thought suppression paradigm there is no such encoding inhibitory process.

Another cause of retrieval deficit may be a suppression-related disruption of cooperation between different structures of the brain which are responsible for a successful retrieval of information. It has been shown that different memory systems, even the stages of a particular memory system are operated by different brain regions. Christman (ref) demonstrated an advantage of being mixed-handedness for episodic memory capacities. This is because episodic memory involves the integration between the left and the right hemisphere activities (Tulving et al., 1994) and mixed-handedness is related to increased hemispheric integration (Christman et al., 2001; 2006). It has been observed in this study that mixed-handed participants lost such memory advantage after a successful suppression involvement. Therefore, a detrimental effect of thought suppression on hemispheric integration process, which results in impaired episodic memory, can be suggested. On the other hand, it should be considered that such conclusion of the study depends on indirect measure of hemispheric integration. Therefore, we cannot provide definite explanations about the mechanism through which thought suppression mediates the relationship between mixed-handedness and episodic memory performance.

Christman et al. (2003) and Parker et al. (2008) explained the nature of hemispheric integration underlying episodic memory performance such that in retrieval process neural circuits in the right prefrontal cortex connect with those in the left prefrontal cortex which stores memory trace for to-be-retrieved information. They suggested that “equalized level of activation facilitates” this connection on the basis of the studies demonstrating an

"increased interhemispheric electroencephalograph (EEG) coherence in during the performance of tasks involving bilateral cerebral and a reduced one during tasks involving a single hemisphere" (Christman et al., 2003, p. 222). Therefore, successful thought suppression may lead to an asymmetry in the activities of cerebral hemispheres by braking the activity of one hemisphere. The effect of successful thought suppression is thought to be in the activity of the left hemisphere. This proposal is based on the finding that perceptual priming effect remained intact on the face of thought suppression which mainly relies on the right hemisphere,

While high suppression success followed by high effort reduced explicit memory performance, high suppression success obtained without high effort reduced implicit memory performance. When subjects found the stimuli more demanding, they exhibited invulnerable implicit memory performance to successful suppression. This finding is more compatible with Wegner's dual process theory (1987; 1992). According to him, suppression mechanism involves one process for providing distracter in order to direct attention away from the target stimuli. This process resembles the system in resource depletion theory. The other is monitoring process, which controls the success of suppression, i.e. detects intrusions. However, monitoring process unintentionally primes the unwanted thoughts. Such priming effect of monitoring process may explain the resistance of implicit memory.

Hypotheses depending on remember-know paradigm were not proved in the current study. One of the reasons for failing to demonstrate

disturbance in associations of suppressed information may be related to theoretical misassumptions about the dual process in recognition memory. Recently, dual-process account of recognition has been challenged. The result of many studies suggested a single process that underlies recognition (e.g. Dunn, 2008; Gardiner, Ramponi, & Richardson-Klavehn, 1999; and Spitzer & Bauml, 2007). According to the single-process theory, recognition involves one source of information which is similar to familiarity process of dual-process model. Conscious recollection of associated detailed is not supposed to underlies recognition performance. Therefore, forget/suppress instructions affect the general strength of memory (Spitzer & Bauml, 2007).

The most probable cause of the inability of indicate any difference in remember and know responses as a function of thought suppression and handedness is that variation in participants' responses may not represent true variation. The first possibility is that although the same instructions were adopted like other studies (i.e. Eldridge et al., 2002), computer based structure of the current study may have been more confusing, or provoke a tendency to press the same keys regardless of their true judgment. Additionally, participants may have had difficulties to understand the distinction between recollection and familiarity based recognitions. It is important to note that the Turkish account of remember-know may produces a misunderstanding in some subjects. Turkish translation of "remember" indicates relatively less confident judgment to the translation of "know". Failure of the results related to remember-know judgment probably

represents a problem in the validity of the subjects' responses. On the other hand, recognition task was easier to perform.

4.1 Implications for Psychoanalytic Ideas and Psychotherapy

This study has importance for creating a similar process in psychoanalytic defense mechanism of repression, in terms of the target stimuli. Many previous studies have examined thought suppression with neutral stimuli. However, neural stimuli are not subjected to repression. Rather, overwhelming emotions, unbearable situations, or unaccepted desires create motivation for repression. However, because of high personal relevance, such materials are more resistant to disappear. As Freud (1915) proposed long ago, even thought there is no conscious access to repressed thoughts, their traces are observable through unconscious mechanism, such as dreams, tongue slips, and symptoms. Thought suppression is related to at least one form of repression. To-be suppressed stimuli in the present study were compatible with those subjected to repression. The majority of the participants reported fear, anxiety, worries, guilt, shame, and rage in response to the study photos in their free writings and during debriefing.

Although the results of the study were not too powerful, they carry some implications for psychoanalytic ideas. For instance, small but considerable evidence was provided for repression theory that repressed thoughts disappear only from the conscious part of the mind and keeps its power on the unconscious processes. In the current study forgetting in explicit systems, but not in implicit systems, in response to suppression

attempt occurred only when participants found the target stimuli subjectively demanding. Likewise, only demanding thoughts that are unbearable undergo repression.

Some interpretation regarding the psychoanalytic hypothesis on neurobiological mechanisms of repression can be made on the basis of present findings. It has been hypothesized that the right hemisphere is the place of psychodynamic unconscious and the left hemisphere is the place of psychodynamic conscious (Schore, 2005). Repression involves an impediment in connection of right hemisphere processes to verbal left hemisphere functions "by inhibition of neural transmission across the corpus callosum" (Galin, as cited in Jones, 1993, p. 71). Although, unconscious right hemisphere and conscious left hemisphere proposal is controversial, repression may involve a decreased integration (i.e. asymmetric activity levels) in corresponding memory regions of the left and the right hemispheres.

At the first year of life, all experiences are mainly encoded in the structure of right hemisphere and due to the immaturity of the left hemisphere they lack verbal representations, thus conscious access. Primary repression has been identified as a result of different developmental timetables of the right and left hemispheres. Moreover, it has been suggested that the aim of the psychoanalytic psychotherapy is to help the patient to integrate the fragmented information relying on the two hemispheres of the brain through exploring past in relation to today, and form adaptive and comprehensive self narratives. In that sense, "integration

is the way in which functionally distinct components come to be clustered into a functional whole" (Siegle, 2001, p. 70). As Fosshage (2003) argues, inquiring the early experiences help to recollect patients' implicit knowledge. Therefore, the patient finds opportunity to take distance from what is unknown to him/her, and to work through it.

The results of the study may have some implications for the mechanisms of eye movement desensitization and reprocessing (EMDR) which is developed by Shapiro and used as a therapeutic technique in the treatment of PTSD (as cited in Christman et al., 2003). This technique involves bilateral saccadic eye movements that are presumably associated with interhemispheric integration. Therapist applying EMDR technique has been indicated an increase in conscious retrieval of traumatic episodes, which in turn associated with successful therapeutic outcomes (e.g. van der Kolk, Burbridge, & Suzuki, as cited in Christman et al., 2003)

4.2 Limitations and Implications for Further Research

The major drawback of the present study was the absence of an adequate sample size that allows analyses of interaction among different conditions. Inadequate sample size was especially evident in the analyses regarding suppression success and suppression effort. Because of that these statistical analyses were conducted via nonparametric tests. However, "nonparametric test may lack the power to reject null hypothesis", if it is false (Kinnear & Gray, 2000, p. 147). Moreover, this study lacks the opportunity for examining a triple interaction among suppression effort,

suppression success and degree of handedness on memory processes due to inadequate sample size of each category of interaction. For future studies, a larger sample enabling the application of such analysis is recommended.

For examining the potential neurobiological mechanism underlying the relationship between thought suppression and decreased interhemispheric integration, this study does not provide definite conclusions due to its methodology. In order to make more confident conclusions, brain activations should be directly assessed during and after thought suppression, and during implicit and explicit retrieval of suppressed and nonsuppressed information. Moreover, the role of bilateral brain activity in emotion regulation is not clear yet. Techniques of neuroscience should be applied in order to get a deeper insight about emotion regulation mechanisms.

The current study failed to indicate the validity and reliability of participants' remember-know judgments. For future research including remember-know paradigm, some strategies should be developed in order to check whether participants' understanding of the task is accurate and the variation in their responses reflect their true variation.

Finally, this study does not provide opportunity for comparing implicit and explicit performances of the same person as a function of thought suppression (i.e. within-subjects studies). Furthermore, follow-up studies are recommended to see long-term effects of thought suppression on both memory processes and regulation of emotional experience.

4.3 Summary and Conclusion

Thought suppression, one of the emotion regulation strategies, involves conscious attempt to avoid unwanted thoughts. Thought suppression precedes repressions, at least in one type of repression (i.e. automatized suppression). The present study investigated the effect of thought suppression on different forms of memory systems and its relation to degree of handedness which is assumed as an indication of interhemispheric integration. The result of the study indicated no effect of mere suppression instruction in all conditions. However, marginal impairment in conscious retrieval of suppressed stimuli was observed only when individuals manage to refuse to think of unwanted thoughts even though they found the target too demanding to suppress. Under this condition implicit memory performance was preserved as compared to other conditions (i.e. suppression with high success-low effect, low success-low effort, and low success-high effort). Erosion of traces of suppressed stimuli was detected only when the participants found the target stimuli personally irrelevant and successfully suppressed them. It is concluded that while depletion of resources associated with rehearsal interruption provides the best explanation for the disturbance in explicit memory performances, priming effect of monitoring process is more sufficient to explain an intact implicit memory performance. These findings represent a similar process in repression. Moreover, successful thought suppression was associated with a decline in episodic memory performance of mixed-handed individuals. Therefore, a potential relation of thought suppression to decreased

hemispheric integration was suggested. Potential role of bilateral brain activities in emotion regulation, particularly in perceiving the external world as less threatening/negative was pointed. Nonetheless, the current study failed to provide evidence for suppression effect on decreased retrieval of associated details, and on the relationship between mixed-handedness and retrieval of associated details. Even though the presence of some limitations and inadequacies, the present study has importance for providing an integrative frame for thought suppression theories, suggesting an experimental setting for examining at least one type of repression, and pointing to the role of interhemispheric integration in regulating negative emotional experiences.

CHAPTER 5: References

Aggleton, J. P., & Brown, M. W. (1999). Episodic memory, amnesia, and the hippocampal–anterior thalamic axis. *Behavioral and Brain Sciences, 22,* 425-489.

Anderson, M. C., Bjork, R. A., & Bjork, E. L. (1994). Remembering can cause forgetting: Retrieval dynamics in long-term memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20,* 1063-1087.

Anderson, M. C., Ochsner, N. K., Kuhl, B., Cooper, J. Robertson, E., Gabrieli, S. W., Glover, G. H., Gabrieli, J. D. E. (2004). Neural systems underlying the suppression of unwanted memories. *Science, 303*, 232-235.

Barnier, A. J., Hung, L., & Conway, M. A. (2004). Retrieval-induced forgetting of emotional and unemotional autobiographical memories. *Cognition and Emotion, 18,* 457-477.

Barry, E. S., Naus, M. J., & Rehm, L. P. (2004). Depression and implicit memory: Understanding mood congruent memory bias. *Cognitive Therapy and Research, 28,* 387–414.

Bechara, A., Tranel, D., Damasio, H., Adolphs, R., Rockland, C., & Damasio, A. R. (1995). Double dissociation of conditioning and declarative knowledge relative to the amygdala and hippocampus in humans. *Science, 269,* 1115–1118.

Bjork, E. L. (1970). Positive forgetting: the non-interference of items intentionally forgotten. *Journal of Verbal Learning and Verbal Behavior, 9,* 255-268.

Bjork, E. L., & Bjork, R. A. (2003). Intentional forgetting can increase, not decrease, residual influences of to-be-forgotten information. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 29*, 524–531

Blaxton, T. A., & Theodore, W. H. (1997). The role of the temporal lobes in recognizing visuospatial materials: Remembering versus knowing. *Brain and Cognition*, *35*, 5-25.

Boag, A. (2007). The real process and explanatory status of repression and inhibition. *Philosophical Psychology, 20,* 375-392.

Bond, M. (2004). Empirical studies of defense style: Relationship with psychopathology and change. *Harvard Review of Psychiatry, 12*, 263-278.

Bower, G. H. (1981). Mood and memory. *American Psychologist, 36*, 129 148.

Campos, J. J., Frankel, C. B., & Camras, L. (2004). On the nature of emotion regulation. *Child Development, 75,* 377-394.

Carlson, N. R. (2004). *Physiology of Behavior* (8th Ed). Boston: Pearson Education.

Christman, S. D., Garvey, K. J., Propper, R. E., & Phaneuf, K. A. (2003). Bilateral eye movements enhance the retrieval of episodic memories. *Neuropsychology, 15,* 221-229.

Christman, S. D., & Propper, R. E. (2001). Superior episodic memory is associated with interhemispheric processing. *Neuropsychology, 15*, 607-616.

Christman, S. D., Propper, R. E., & Brown, T. J. (2006). Increased interhemispheric interaction is associated with earlier offset of childhood amnesia. *Neuropsychology, 20,* 336-345.

Cougle, J. R., Smits, J. A. J., Lee, H., Powers, M. B., & Telch, M. J. (2005). Singular and combined effects of thought suppression and anxiety induction on frequency of threatening thoughts: An experimental investigation. *Cognitive Therapy and Research, 29,* 525-539.

Cozolino, L. J. (2002). *The neuroscience of psychotherapy*. New York: W. W. Norton & Company.

Cronin-Golomb, A., Gabrieli, J. D. E., & Keane, M. M. (1996). Implicit and explicit memory retrieval within and across the disconnected cerebral hemispheres. *Neuropsychology, 10,* 254-262.

Damasio, A. R. (1994). *Descartes' Error: Emotion, Reason, and the Human Brain.* New York: Avon.

Davidson, R. J., Jackson, D. C., & Kalin, N. H. (2000). Emotion, plasticity, context, and regulation: perspectives from affective neuroscience. *Psychological Bulletin, 126*, 890-909.

De Bellis, M. D., Keshavan, M. S., Clark, D. B., Casey, B. J., Giedd, J. N., Boring, A. M., Frustaci, K., & Ryan, N. D. (1999). Developmental traumatology part II: Brain development. *Biological Psychiatry, 45*, 1271–1284.

Depue, B. E., Banich, M. T. , & Curan, T. (2006). Suppression of emotional and nonemotional content in memory: Effects of repetition on cognitive control. *Psychological Science, 17*, 441-447.

Dunn, J. C. (2008). The dimensionality of the remember-know task: A state trace analysis. *Psychological Review, 115*, 426-446.

Easterbrook, J. A. (1959). The effect of emotions on cue utilization and the organization of behavior. *Psychological Review, 66,* 183-201.

Ekehammar, B. O., Zuber, I., & Konstenius, M. L. (2005). An empirical look at the defense mechanism test (DMT): Reliability and construct validity. *Scandinavian Journal of Psychology, 46,* 285-296.

Eldridge, L. E., Sarfatti, S., & Knowlton, B. J. (2002). The effect of testing procedure on remember–know judgments. *Psychological Bulletin and Review, 9,* 139-145.

Epözdemir, H. (2008). Standardization of a Turkish version of Symptom Assessment-45 Questionnaire. Unpublished dissertation, İstanbul Bilgi University, İstanbul.

Erten, Y. (2006). In his lectures on psychodynamic theories and therapies.

Fleck, D. E., Berch, D. B., Shear, P. K., & Strakowski, S. M. (2001). Directed forgetting in explicit and implicit memory: The role of encoding and retrieval mechanisms. *Psychological Record, 51*, 207-221.

Fransson, P., Sundbom, E., & Hagglof, B. A. (1998). Comparative study of adolescents in psychiatric care assessed by means of the Defense Mechanism Test and the DSM-IV classification system. *Nord Journal of Psychiatry, 52*, 527-536.

Freud, S. (1911). Formulations on the two principles of mental functioning. *The Standard Edition of the Complete Psychological Works of Sigmund Freud, Volume XII (1911-1913): The Case of Schreber, Papers on Technique and Other Works*, 213-226.

Freud, S. (1915). Repression. *The Standard Edition of the Complete Psychological Works of Sigmund Freud, Volume XIV (1914-1916): On the History of the Psycho-Analytic Movement, Papers on Metapsychology and Other Works,* 141-158.

Fosshage, J. L. (2003). Fundamental pathways to change: Illuminating old and creating new relational experience. *International Forum of Psychoanalysis, 12,* 244-251.

Gallagher, H. L., & Frith, C. D. (2003). Functional imaging of theory of mind. *Trends in Cognitive Sciences, 7,* 51-96.

Gardiner, J. M., Ramponi, C., & Richardson-Klavehn, A. (1999). Response deadline and subjective awareness in recognition memory. *Consciousness and Cognition 8,* 484-496.

Gazzaniga, M. S., Ivry, R. B., & Mangun, G. R. (2002). *Cognitive Neuroscience* (2nd Ed.). New York: W. W. Norton & Company.

Geiselman, R. E., Bjork, R. A., & Fishman, D. (1983). Disrupted retrieval in directed forgetting: A link with posthypnotic amnesia. *Journal of Experimental Psychology: General, 112,* 58-72.

Geisler, C. (1985). Repression: A psychoanalytic perspective revisited. *Psychoanalysis and Contemporary Thought, 8,* 253-298.

Geraertsa, E., Merckelbacha, H., Jelicica, M., & Smeetsa, E. (2006). Long term consequences of suppression of intrusive anxious thoughts and repressive coping. *Behaviour Research and Therapy*, *44,* 1451-60.

Gross, J. J. (1998). Antecedent-and response- focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology, 74,* 224-237.

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology, 39,* 281-291.

Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting positive and negative emotions. *Journal of Abnormal Psychology, 106,* 95-103.

Hamann, S. (2001). Cognitive and neural mechanisms of emotional memory. *Trends in Cognitive Sciences, 5,* 394-400.

Happaney, K., Zelazo, P. D., & Stuss, D. T. (2003). Development of orbitofrontal function: Current themes and future directions. *Brain and cognition, 55*, 1-10.

Harvey, A. G., & Bryant, R. A. (1998). The effect of attempted of attempted thought suppression in acute stress disorder. *Behaviour Research and Therapy*, *36,* 583-590.

Janeck, A. S., Calamari, J. E. (1999). Thought suppression in obsessive compulsive disorder. *Cognitive Therapy and Research, 23*, 497-509.

Jones, B. P. (1993). Repression: The evolution of psychoanalytic concept from the 1980's to the 1990's. *Journal of American Psychoanalytic Association, 41,* 63-93.

Kandel, E. R. (1999). Biology and the future of psychoanalysis: A new intellectual framework for psychiatry revisited. *American Journal of Psychiatry, 156,* 505-524.

Kinnear, P. R., & Gray, C. D. (1997). *SPSS for Windows Made Simple*. Hove, United Kingdom: Psychology Press.

Klein, K., & Bratton, K. (2007). The costs of suppressing stressful memories. *Cognition and Emotion, 21,* 1496-1512.

LeDoux, J. (1998). *The emotional brain*. New York: Touchstone.

Liederman, J. (1998). The dynamics of interhemispheric collaboration and hemispheric control. *Brain and Cognition 36,* 193-208.

Lyle, K. B., McCabe, D. P., & Roediger, H. L. (2008). Handedness is related to memory via hemispheric integration: Evidence from paired associate recall and source memory tasks. *Neurophysiology, 22,* 523-530.

Macrae, C. N., Bodenhausen, G.V., Milne, A. B., & Ford, R. L. (1997). On regulation of recollection: The intentional forgetting of stereotypical memories. *Journal of Personality and Social Psychology, 72,* 709-719.

Mark E. Maruish, M. E. (2000). *The Symptom Assessment-45 Questionnaire Technical Manual* (2nd Ed.). Toronto: Multi-Health Systems Inc.

McWilliams, N. (1994). *Psychoanalytic Diagnosis.* New York: Guilford Press.

McKinney, L. C., & Woodward, A. E. (2004). Remembering what one intended to forget: The lack of directed forgetting effect in implicit memory. *American Journal of Psychology, 117,* 169-190.

Mitchell, D. B. (2006). Nonconscious priming after 17 years. Invulnerable implicit memory? *Psychological Science, 17*, 925-929.

Ochsner, K. N., & Gross, J. J. (2005). The cognitive control of emotions. *Trends in Cognitive Sciences, 9,* 242-249.

Oldfield, R. C. (1971). The assessment and analysis of handedness: The Edinburgh inventory. *Neuropsychologia, 9,* 97–114.

Öner, N. (1977). Durumluluk, Sürekli Kaygı envanterinin Türk toplumunda geçerliliği [The validity of State-Trait Anxiety Inventory in Turkish sample], Doktora Tezi, Hacettepe University, Ankara.

Packard, M. G., & Wingard, J. C. (2004). Amygdala and emotional modulation of the relative use of multiple memory systems. *Neurobiology of Learning and Memory, 82,* 243-252.

Parker, A., Relph, S., & Dagnall, N. (2008). Effects of bilateral eye movements on the retrieval of item, associative, and contextual information. *Neuropsychology, 22,* 136-145.

Phelps, E. A. (2006). Emotion and cognition: insights from studies of the human amygdala. *Annual Review of Psychology, 57,* 27-53.

Propper, R.E., & Christman, S. D. (2004). Mixed-versus strong right handedness is associated with biases towards remember versus know judgments in recognition memory: Role of interhemispheric interaction. *Memory, 12,* 707-714.

Rassin, E. (2001). Thought suppression, memory, and interrogative suggestibility. *Psychology, Crime, and Law, 7,* 45-55.

Richards, J. M., & Gross, J. J. (2005). Personality and emotional memory: How regulating emotion impairs memory for emotional events. *Journal of Research in Personality* (In press).

Ross, J. M. (2003). Preconscious defense analysis, memory, and structural change. *The International Journal of Psychoanalysis, 84,* 59-76.

Sapolsky, R. M. (2004). Stress and cognition. In M. S. Gazzaniga (Eds.), *The cognitive neuroscience III* (pp. 1031-1042). Cambridge: The MIT Press.

Sherman, J. W., Stroessner, S. J., Loftus, S.T., & Deguzman, G. (1997). Stereotype suppression and recognition memory for stereotypical and nonstereotypical information. *Social Cognition, 15,* 205–15

Schore, A. N. (2005). A neuropsychoanalytic viewpoint. *Psychoanalytic Dialogues, 15*, 829-854.

Siegel, D. J. (2001). Toward an interpersonal neurobiology of the developing mind: Attachment relationships, “mindsight”, and neural integration. *Infant Mental Health Journal, 22,* 67-94.

Solms, M., & Turnbull, O. (2002). *The brain and the inner world.* London: Paterson Marsh Agency.

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *Manual for the State-Trait Anxiety Inventory.* Palo Alto, CA: Consulting Psychologists Press.

Spitzer, B., & Bauml, K. H. (2007). Retrieval-induced forgetting in item recognition: Evidence for a reduction in general memory strength. *Journal of Experimental Psychology: Learning, Memory and Cognition, 33*, 863-875.

Storm, B. C., Bjork, E. L., & Bjork, R. A. (2005). Social metacognitive judgments: The role of retrieval-induced forgetting in person memory and impressions. *Journal of Memory and Language, 52,* 535–550.

Tulving, E. (1985). How many memory systems are there? *American Psychologist, 40,* 385-398.

Tulving, E., Kapur, S., Craik, F. I. M., Moscovitch, M., & Houle, S. (1994). Hemispheric encoding/retrieval asymmetry in episodic memory: Positron emission tomography findings. *Proceedings from the National Academy of Science, USA, 91,* 2016–2020.

Valentiner, D. P., Hood, J., & Hawkins, A. (2006). Differentiating thought suppression and the suppression of emotional expression. *Cognition and Emotion, 20,* 729-735.

Verde, M. F. (2004). The retrieval practice effect in associative recognition. *Memory and Cognition, 32,* 1265-1272.

Wegner, D. M., & Erber, R. (1992). The hyperaccessibility of suppressed thoughts. *Journal of Personality and Social Psychology, 63,* 903-912.

Wegner, D. M., Erber, R., Zanakos, & S. (1993). Ironic processes in the mental control of mood and mood-related thought. *Journal of Personality and Social Psychology, 65,* 1093-1104.

Wegner, D. M., Quillian, F. & Houston, C. E. (1996). Memories out of order: Thought suppression and the disturbance of sequence memory. Journal of Personality and Social Psychology, 71, 680-691.

Wegner, D. M., Schneider, D. J., Carter, S. R., & White, T. L. (1987). Paradoxical effects of thought suppression. *Journal of Personality and Social Psychology, 53,* 5–13.

Wegner, D. M., Shortt, J. W., Blake, A. W., & Page, M. S. (1990). The suppression of exiting thoughts. *Journal of Personality and Social Psychology, 58*, 409-418.

Wegner, D. M., & Smart, L. (1997). Deep cognitive activation: A new approach to the unconscious. *Journal of Consulting and Clinical Psychology, 65,* 984-995.

Wenzlaff, R. M., & Bates, D. E. (1998). Unmasking a cognitive vulnerability to depression: how lapses in mental control reveal depressive thinking. *Journal of Personality and Social Psychology, 75*, 1559-1571.

Wenzlaff, R. M., & Wegner, D. M. (2000). Thought suppression. *Annual Reviews of Psychology, 51,* 59-91.

Werman, D. S. (1983). Suppression as a defense. *Journal of the American Psychoanalytic Association, 31,* 405-415.

Wessel, I., & Hauer, B. (2006). Retrieval-induced forgetting of autobiographical memory details. *Cognition and Emotion, 20*, 430 447.

Whetstone, T., & Cross, M. D. (1998). Control of conscious content in directed forgetting and thought suppression. *Psyche, 4* (http://psyche.cs.monash.edu.au/v4/psyche-4–16-whetstone.html).

Witelson, S. (1985). The brain connection: The corpus callosum is larger in left-handers. *Science, 229,* 655–668.

Wyland, C. L., & Forgas, J. P. (2007). On bad mood and white bears: The effects of mood state on ability to suppress unwanted thoughts. *Cognition and Emotion, 21,* 1513-1524.

Yonelinas, A. P. (2002). The nature of recollection and familiarity: A review of 30 years of research. *Journal of Memory and Language, 46,* 441-517.

CHAPTER 6: Appendices

Appendix A: Informed consent

Bilgi ve Onay Formu

Sayın Katılımcı;

'Duygu ve Bilişsel İşlevler' konulu çalışmama gönüllü katılımınızı rica ediyorum. Bu çalışmanın amacı duyguların bilişsel süreçlere etkilerini araştırmaktır.

Bu çalışmaya katılmak için araştırmacıyla yaklaşık olarak kırk beş dakika sürecek bir görüşme gerçekleştirmeniz gerekmektedir.

Katılımcı olarak kimliğiniz gizli tutulacaktır. Ad soyad gibi kişisel bilgileriniz sadece bu onay formunun üzerinde yer alacak, bu form da diğer anketlerden ayrı bir yerde saklanacaktır. Diğer anket formlarının üzerinde sadece her katılımcıya verilen kimlik numarası yer alacaktır. Bu araştırmada dile getirilen görüşler anonim olarak ve bir grup halinde değerlendirilecek, böyle bir araştırmaya katıldığınız bilgisi hiç kimse ile paylaşılmayacak, kişisel bilgileriniz araştırmadan çıkan herhangi bir yayın ya da sunumda kullanılmayacaktır.

Araştırmaya katılımınızın size herhangi bir zarar vereceği öngörülmemektedir. Katılmak gönüllülük esasına dayanmaktadır ve istediğiniz anda çalışmaya devam etmeme hakkına sahipsiniz. Çalışmadan geri çekilme durumunda söz konusu ders için 2 kredi kazanma hakkını kaybetmeyeceksiniz. Sizden ricamız eğer bu çalışmaya katılmaya gönüllü olursanız, araştırmamızın güvenirliği açısından anketin tümünü olabildiğince samimi ve etraflıca yanıtlamanızdır.

Bu araştırma İstanbul Bilgi Üniversitesi Klinik Psikoloji yüksek lisans öğrencilerinden Gülcan Akçalan'ın (gakcalan@bilgi.edu.tr) yüksek lisans bitirme tezi için yürütülmektedir. Araştırmanın danışmanı Doğuş Üniversitesi psikoloji bölümü öğretim üyesi Yrd. Doç. Dr. Hasan Bahçekapılı'dır. (hbahcekapili@dogus.edu.tr). Araştırma ile ilgili sorularınız olursa bu kişilere ulaşabilirsiniz.

Bu araştırmaya katkıda bulunduğunuz için teşekkür ederiz.

* * * *

Yukarıdaki açıklamayı okudum, belirtilenleri anladım, bu formun bir örneğini de aldım ve bu çerçevede bu araştırma projesine katılmayı kabul ediyorum.

_____	_____	_____
Katılımcının adı-soyadı	Katılımcının imzası	Tarih

Appendix B: Questionnaire for assessing the presence of inclusion criteria

Kişisel Bilgi Formu

1. Tarih:
2. Yaşınız:
3. Cinsiyetiniz: K ☐ E ☐
4. Şu anda herhangi bir sağlık sorunu yaşıyor musunuz? Evetse açıklar mısınız?

5. Şu anda ya da geçmişte bir psikologa, psikiyatriste ya da nörologa başvurdunuz mu? Evetse açıklar mısınız (ne zaman, ne sebeple, ne r süre yardım aldınız)?

   Hayır ☐ Evetse;

Sebebi
Zamanı
Yardım alınan süre
Bu durum halen devam ediyor mu?

6. Şu anda ya da geçmişte herhangi bir psikiyatrik ilaç kullanıyor musunuz ya da kullandınız mı? Evetse açıklar mısınız (ne zaman, ne sebeple, ne kadar süre)?

   Hayır ☐ Evetse;

Sebebi
Zamanı
Süresi
Bu ilacı/ilaçları halen kullanıyor musunuz?

7. Şu anda görmeyle ilgili bir probleminiz var mı? Evetse açıklar mısınız? Şu anda bu probleminiz için gözlük, lens, ilaç vb. bir şey kullanıyor musunuz?

Appendix C: Turkish version of the Symptom Assessment-45 Questionnaire (SA-45)

Zaman zaman karşılaşabildiğimiz problemlerin bir listesi aşağıda verilmiştir. Dikkatle okuduktan sonra bugün dâhil son 7 gün boyunca bu problemlerin sizde yarattığı rahatsızlık veya gerginliğin derecesini en iyi tanımlayan sayıyı işaretleyin. Her sorun için sadece bir işaretleme yapın ve herhangi bir seçeneği atlamamaya özen gösterin. Teşekkürler...

1	Kendimi yalnız hissediyorum	1	2	3	4	5
2	Hüzünlüyüm	1	2	3	4	5
3	Hiçbir şey ilgimi ekmiyor	1	2	3	4	5
4	Korkuyorum	1	2	3	4	5
5	Başkalarının düşüncelerimi kontrol edebileceğini düşünüyorum	1	2	3	4	5
6	Sorularımın birçoğu için başkalarını suçluyorum	1	2	3	4	5
7	Açık alanlarda veya sokakta korkuyorum	1	2	3	4	5
8	Başkalarının duymadığı sesler duyuyorum	1	2	3	4	5
9	Çoğu insanın güvenilmez olduğunu düşünüyorum	1	2	3	4	5
10	Sebepsiz yere birden bire korkuya kapılıyorum	1	2	3	4	5
11	Kontrol edemediğim öfke patlamaları yaşıyorum	1	2	3	4	5
12	Tek başıma evden çıkmaya korkuyorum	1	2	3	4	5
13	Diğer insanların kafamdaki düşüncelerin farkında olduğunu düşünüyorum	1	2	3	4	5
14	İnsanların beni anlamadığını ve hislerimi paylaşmadığını düşünüyorum	1	2	3	4	5
15	İnsanların bana dostça yaklaşmadığını ve benden hoşlanmadığını düşünüyorum	1	2	3	4	5
16	Düzgünlüğünden ve doğruluğundan emin olmak için işleri çok yavaş yapmak zorundayım	1	2	3	4	5
17	Kendimi diğerlerine göre daha aşağı hissediyorum	1	2	3	4	5
18	Adale ağrılarım var	1	2	3	4	5
19	Başkalarının beni gözetlediğini veya benim hakkımda konuştuğunu düşünüyorum	1	2	3	4	5
20	Yaptığımı tekrar tekrar kontrol ediyorum	1	2	3	4	5
21	Karar vermekte zorlanıyorum	1	2	3	4	5
22	Otobüs, metro veya trenle yolculuk yapmaktan korkuyorum	1	2	3	4	5
23	Sıcak basıyor veya soğuk soğuk terliyorum	1	2	3	4	5
24	Beni korkuttukları için, belli şeyler, yerler ya da faaliyetlerden kaçınıyorum	1	2	3	4	5
25	Zihnim birden boşalıyor	1	2	3	4	5
26	Vücudumun bazı kısımları uyuşuyor veya karıncalanıyor	1	2	3	4	5
27	Gelecek hakkında umutsuzum	1	2	3	4	5
28	Konsantre olmakta güçlük çekiyorum	1	2	3	4	5
29	Vücudumun bazı kısımlarında güçsüzlük hissediyorum	1	2	3	4	5
30	Kendimi gergin ya da tedirgin hissediyorum	1	2	3	4	5
31	Kollarında veya bacaklarımda ağırlık hissediyorum	1	2	3	4	5
32	İnsanlar bana baktıklarında veya benim hakkımda konuştuklarında kendimi rahatsız hissediyorum	1	2	3	4	5
33	Kendime ait olmaya düşüncelerim var	1	2	3	4	5
34	Birine vurma, incitme veya zarar verme isteği geliyor	1	2	3	4	5
35	Bir şeyleri kırma veya ezme isteği geliyor	1	2	3	4	5
36	İnsanlarla beraberken beni nasıl algılayacaklar diye tedirgin oluyorum	1	2	3	4	5
37	Alışveriş yerleri veya sinema gibi kalabalık yerlerde kendimi rahatsız hissediyorum	1	2	3	4	5
38	Korku veya panik nöbetleri yaşıyorum	1	2	3	4	5
39	İnsanlarla sık sık tartışıyorum	1	2	3	4	5

40	İnsanlar başarılarımı yeteri kadar takdir etmiyor	1	2	3	4	5
41	O kadar huzursuzum ki, bir türlü yerimde duramıyorum	1	2	3	4	5
42	Kendimi değersiz hissediyorum	1	2	3	4	5
43	Bağırıyorum veya bir şeyler fırlatıyorum	1	2	3	4	5
44	İzin verirsem insanların benden yararlanmak isteyeceklerini düşünüyorum	1	2	3	4	5
45	İşlediğim günahlar için cezalandırılmam gerektiğini düşünüyorum	1	2	3	4	5

Appendix D: Turkish version of The Edinburgh Handedness Inventory

**Aşağıdaki tabloda önce, söz konusu faaliyeti yaparken hangi elinizi kullanmayı tercih ettiğinizi 2. sütun üzerinde belirtiniz. Söz konusu faaliyet için her iki elinizi de eşit şekilde kullanabiliyorsanız "FARK ETMEZ" seçeneğini işaretleyiniz.

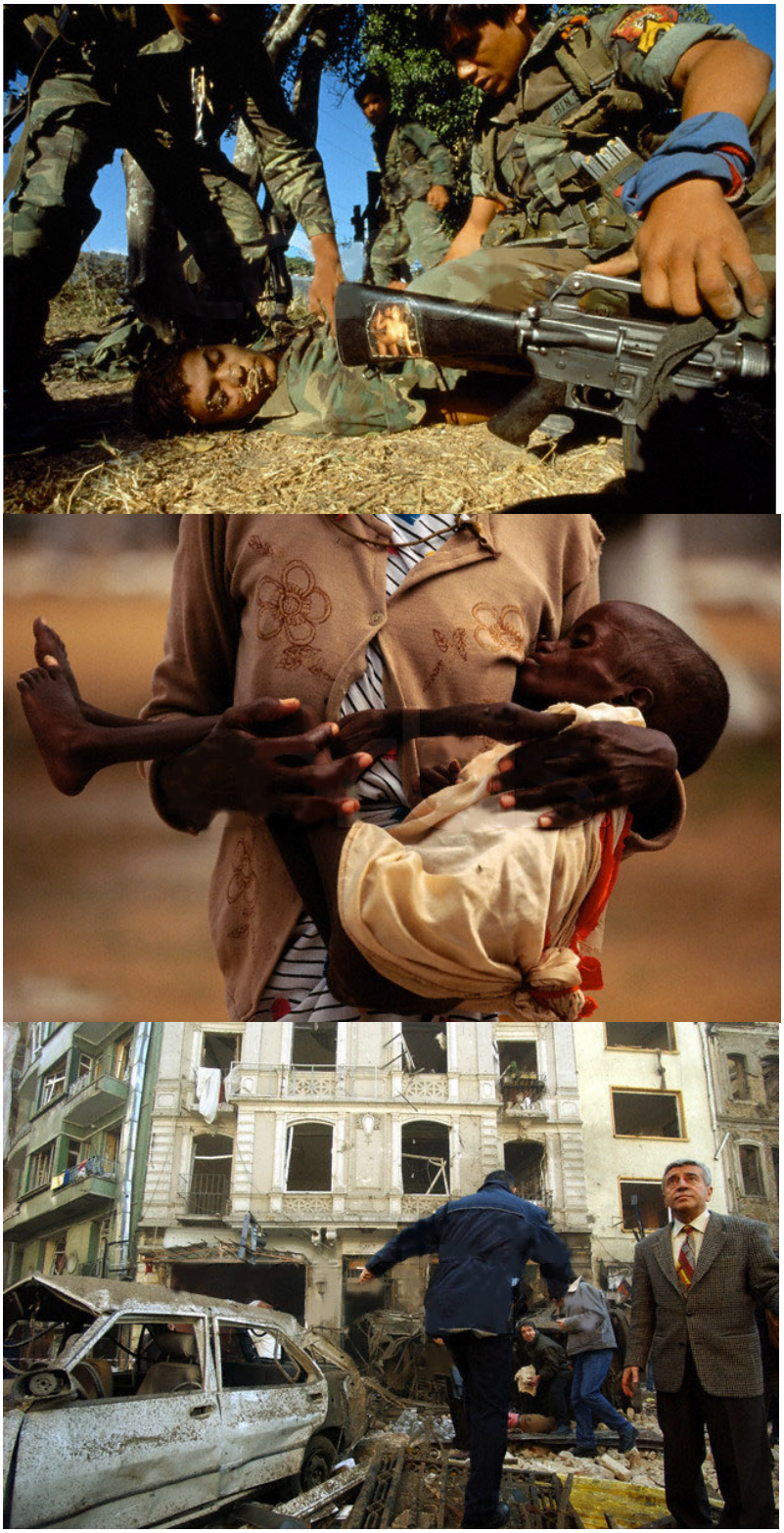
**Hemen ardından da (eğer ilk değerlendirmede "fark etmez" demediyseniz) söz konusu faaliyeti yaparken hiç diğer elinizi kullanıp kullanmadığınızı 3. sütun üzerinde belirtiniz. Eğer söz konusu faaliyet için, diğer elinizi çok zorunda kalmadıkça kullanmayı hiç denemiyorsanız "HAYIR" cevabını işaretleyiniz.

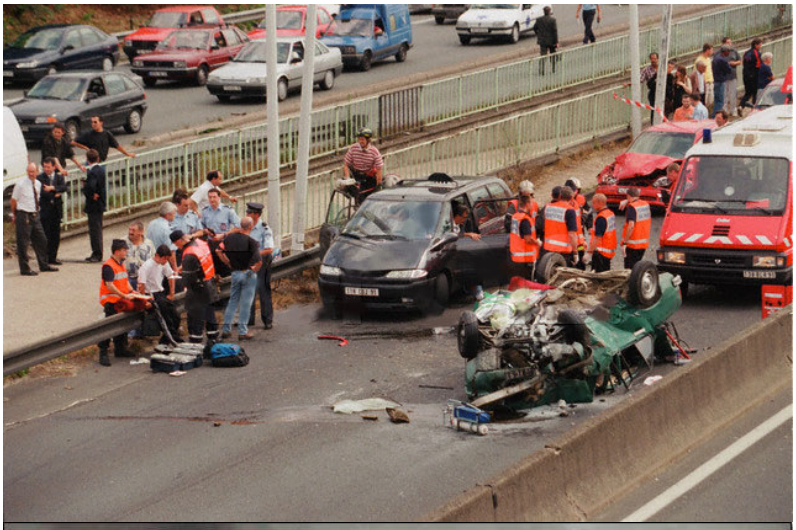
**Aşağıda belirtilen faaliyetlerin bazıları iki el kullanmayı gerektirmektedir. Böyle durumlarda hangi elin kastedildiği parantez içinde belirtilmektedir.

Faaliyet	**Hangi elinizi tercih edersiniz?**	**Hiç diğer elinizi kullanır mısınız?**
Yazarken	☐ SAĞ ☐ SOL ☐ FARK ETMEZ	☐ EVET ☐ HAYIR
Resim yaparken	☐ SAĞ ☐ SOL ☐ FARK ETMEZ	☐ EVET ☐ HAYIR
Bir şey fırlatırken	☐ SAĞ ☐ SOL ☐ FARK ETMEZ	☐ EVET ☐ HAYIR
Makas kullanırken	☐ SAĞ ☐ SOL ☐ FARK ETMEZ	☐ EVET ☐ HAYIR
Diş fırçalarken	☐ SAĞ ☐ SOL ☐ FARK ETMEZ	☐ EVET ☐ HAYIR
Bıçak kullanırken (çatalsız)	☐ SAĞ ☐ SOL ☐ FARK ETMEZ	☐ EVET ☐ HAYIR
Kaşık kullanırken	☐ SAĞ ☐ SOL ☐ FARK ETMEZ	☐ EVET ☐ HAYIR
Süpürürken (üstteki el)	☐ SAĞ ☐ SOL ☐ FARK ETMEZ	☐ EVET ☐ HAYIR
Kibrit çakarken (kibriti tutan el)	☐ SAĞ ☐ SOL ☐ FARK ETMEZ	☐ EVET ☐ HAYIR
Bir kutuyu açarken (kapağı açan el)	☐ SAĞ ☐ SOL ☐ FARK ETMEZ	☐ EVET ☐ HAYIR

Appendix E: Samples of Study Photos

Appendix F: Samples of Control/Distracter Photos





Appendix G: Samples of Photos used for preventing primary and recency effect.

Appendix H: Turkish version of the State-Trait Anxiety Inventory (STAI) -state anxiety part-

YÖNERGE: Aşağıda kişilerin kendilerine ait duygularını anlatmakta kullandıkları bir takım ifadeler verilmiştir. Her ifadeyi okuyun, sonra şu anda hissettiğinizi ifadelerin sağ tarafındaki parantezlerden uygun olanını işaretlemek suretiyle belirtin. Doğru ya da yanlış cevap yoktur. Herhangi bir ifadenin üzerinde fazla zaman sarf etmeksizin anında nasıl hissettiğinizi gösteren cevabı işaretleyin.

1	Şu anda sakinim	1	2	3	4
2	Kendimi emniyette hissediyorum	1	2	3	4
3	Şu anda sinirlerim gergin	1	2	3	4
4	Pişmanlık duygusu içindeyim	1	2	3	4
5	Şu anda huzur içindeyim	1	2	3	4
6	Şu anda hiç keyfim yok	1	2	3	4
7	Başıma geleceklerden endişe ediyorum	1	2	3	4
8	Kendimi dinlenmiş hissediyorum	1	2	3	4
9	Şu anda kaygılıyım	1	2	3	4
10	Kendimi rahat hissediyorum	1	2	3	4
11	Kendime güvenim var	1	2	3	4
12	Şu anda asabım bozuk	1	2	3	4
13	Çok sinirliyim	1	2	3	4
14	Sinirlerimin çok gergin olduğunu hissediyorum	1	2	3	4
15	Kendimi rahatlamış hissediyorum	1	2	3	4
16	Şu anda halimden memnunum	1	2	3	4
17	Şu anda endişeleniyorum	1	2	3	4
18	Heyecandan kendimi şaşkına dönmüş hissediyorum	1	2	3	4
19	Şu anda sevinçliyim	1	2	3	4
20	Şu anda keyfim yerinde	1	2	3	4

Appendix I: Arithmetical task

"Aşağıda bazı matematik soruları yer almaktadır. Sırayla bu soruları cevaplandırınız. Yapamadığınız soruları geçebilirsiniz."

1. Aşağıdaki işlemleri yapınız.

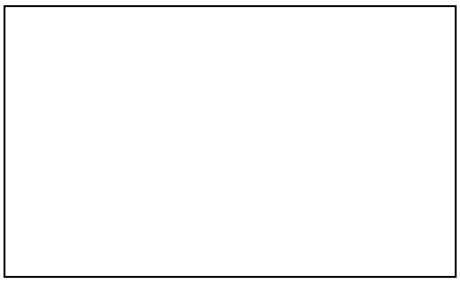
426	504	730	461
557	7	414	281
+_____	**x**_____	**-**_____	+_____

368 | 8 ___	905	861	28
	470	9	47
	-_____	**x**_____	**x**_____

2. **c** ve **d** sayıları üzerinde **#** işlemi;
c # d = $\frac{\mathbf{c} \cdot \mathbf{d}}{\mathbf{c+d}}$ şeklinde tanımlıdır.
Örneğin c=2, d=1 için sonuç,

$2\#1 = \frac{2x1}{2+1} = \frac{2}{3}$ 'tür.

c # 6=4 olduğuna göre **c** değeri nedir?



3. Ezgi, bir kitabı günde ortalama 25 sayfa okuyarak 12 günde bitirmeyi planlıyor. Ezgi, günde ortalama 15 sayfa okursa bu kitabı kaç günde bitirebilir?

4. Bir satıcı, satış fiyatı 480 lira olan bir malı, satış fiyatı üzerinden %20 indirimle sattığında bu malı kaça satmış olur?

5. Aşağıdaki işlemleri yapınız.

1029		702	13	2933		74	
4696				1519		37	
+				-		x	

1651	27	6073		4299		4144	55
		5395		7841			
		-		+			

Appendix J: Remember-Know-Guess Instructions

Şimdi size bir dizi fotoğraf gösterilecektir. Gösterilen fotoğrafların bir kısmı biraz önce görmüş olduğunuz eski fotoğraflardır. Bir kısmı ise daha önce görmediğiniz yeni fotoğraflardır. Sizden, fotoğrafları daha önce görüp görmediğinizi belirtmenizi istiyorum. Her bir fotoğraf için, söz konusu fotoğrafı daha önce gördüyseniz klavyenin **E** tuşuna, görmediyseniz **H** tuşuna basınız.

Evet: E **Hayır: H**

"Evet, bu fotoğrafı ben önceki listede gördüm" dediğiniz durumlarda sizden bir değerlendirme daha yapmanızı istiyorum:

(Devam etmek için herhangi lütfen herhangi bir tuşa basın.)

Bazı tip hatırlamalarda, fotoğrafı önceden gördüğümüzü hatırlamamıza ek olarak o fotoğrafla ilgili olarak yaşadığımız bazı ayrıntıları da hatırlayabiliriz. Mesela, fotoğrafın o listedeki yerini, hangi fotoğraftan önce veya sonra geldiğini, fotoğrafın aklımıza getirmiş olduğu bir olayı veya düşünceyi ya da uyandırdığı bir duyguyu da hatırlayabiliriz. Yani, sadece fotoğrafı gördüğümüzü değil, onu gördüğümüz an ile ilgili bir bilgi de hatırlarız. İşte bu tip hafızaya "**hatırlama**" tipi hafıza diyoruz.

Diğer yandan yine fotoğrafı daha önce gördüğümüzden kesin olarak eminizdir fakat onunla ilgili başka da hiçbir şey hatırlamayız. Yani, o fotoğrafı önceden gördüğümüzü biliriz, ancak onu gördüğümüz an ile ilgili başka bir ayrıntı hatırlamayız. Buna da"**bilme**" tipi hafıza diyoruz.

(Devam etmek için herhangi lütfen herhangi bir tuşa basın.)

Mesela, izlediğimiz bir filmle ilgili, o filme kiminle gittiğimizi, sinemada nerede oturduğumuzu, filmle ilgili o andaki duygu veya düşüncelerimizi vb. birçok ayrıntıyı canlı bir şekilde hatırlayabiliriz. Bu durum **hatırlama** dediğimiz hafıza tipidir. Diğer yandan bazen de, filmi seyrettiğimizi kesin biliriz, filmin içeriğini vs. hatırlarız, ancak ne zaman, kiminle, nerede o filme gittiğimizi kesinlikle hatırlamayız. Bu da **bilme** tipi hafızadır.

Şimdi sizden, gördüğünüzü hatırladığınız her fotoğrafın ardından hafıza tipinizi de belirtmenizi istiyorum. Fotoğrafı gördüğünüz anla ilgili kimi ayrıntıları da hatırlıyorsanız, klavyenin **H** (**hatırlama)** tuşuna basın. Yok, sadece fotoğrafı daha önce gördüğünüzden eminseniz ancak gördüğünüz anla ilgili herhangi bir ayrıntıyı hatırlamıyorsanız, klavyenin **B (bilme)** tuşuna basın.

(Devam etmek için herhangi lütfen herhangi bir tuşa basın.)

Fakat bazen "evet, bu fotoğrafı daha önce gördüm" diye düşünürüz ve "evet" seçeneğini belirtiriz ancak emin değilizdir, gördüğümüzü tahmin ediyoruzdur. Eğer "evet"iniz bu tarz bir hatırlamaysa lütfen klavyenin **T (tahmin)** tuşuna basın.

Hatırlama: H **Bilme: B** **Tahmin: T**

Ekrandaki resmi daha önce görüp görmediğinizi belirttikten hemen sonra, eğer gördüyseniz söz konusu fotoğraf için hafıza tipiniz sorulacaktır. Tuşa basar basmaz bir sonraki fotoğraf ekranda görülecektir. Aynı işlemi her bir fotoğraf için tekrarlayınız. Deneye başlamadan önce 5 fotoğraf ile bir deneme yapacaksınız.

Deneye başlamak için lütfen herhangi bir tuşa basın.

Appendix K: Scales for Suppression Effort (1), and Suppression Success (2)

1) Deneyin başında gösterilen resimleri düşünmemeniz istendiği süre boyunca, resimleri düşünmemek için ne kadar çaba harcadığınızı 0 ila 100 arasında bir sayı ile belirtiniz (0=hiç çaba harcamadım; 100=çok fazla çaba harcadım).

2) Deneyin başında gösterilen resimleri düşünmemeniz istendiği süre boyunca, resimleri düşünmemekte ne kadar başarılı olduğunuzu, yani resimleri ne derece zihninizden uzak tutabildiğinizi 0 ila 100 arasında bir sayı ile belirtiniz (0=hiç başarılı olamadım, yani resimler sürekli aklıma geldi; 100=son derece başarılı oldum, yani resimler hiç aklıma gelmedi).