Source monitoring in autobiographical recall:

A complementary approach to reminiscence bump accounts

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Abstract

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The distribution of autobiographical memories constitutes one of the robust findings in memory research. The present study, with the aim of interpreting the distribution of autobiographical memories as a function of frontal function and source monitoring performance, is conducted with participants between 20 and 89 years of age. The data from autobiographical recall, as assessed by the cue-word paradigm, source monitoring performance, and frontal function as assessed by two different tests, the Wisconsin Card Sorting Test and the Stroop Test, was analyzed to investigate the hypothesis that impaired frontal function and source monitoring in old age might be two factors contributing to the consistently observed bump in the distribution of autobiographical memories. Although the findings provided support for hypotheses regarding the individual components of the study, the main hypothesis received only partial support. The findings are discussed in relation with the wider arena of memory research as well as with the theoretical and methodological implications that they present for future research.

Özet

Otobiyografik anıların hatırlanmasında ve anı tümseğini açıklamada yardımcı bir yaklaşım olarak kaynak belleği ve kaynak belirleme

İdil Ayça Karaca

Bu çalışma otobiyografik anıların yaşlara gore dağılımını frontal fonksiyonlar ve kaynak belirleme performansıyla ilişkilendirilerek yorumlama amacıyla 20-89 yaş arası yetişkinlerle gerçekleştirilmiştir. Uyaran sözcük yöntemiyle elde edilen otobiyografik bellek verileri, Wisconsin Kart Eşleme Testi ve Stroop Testi ile değerlendirilen frontal fonksiyonlara ilişkin veriler ve kaynak belirleme performansı verileri bu üç alan arasındaki ilişkileri belirleme amacıyla incelenmiştir. Frontal fonksiyonlarda ve kaynak belirlemede yaşlılıkla beraber görülen düşüşün yine bu yaş grubunda tutarlı bir şekilde gözlemlenen anı tümseğinin oluşmasına katkısı test edilmiştir. Bu çalışmanın her bir bölümüyle ilgili hipotezler beklenen şekilde doğrulanmış olmakla birlikte, frontal fonksiyonların ve kaynak belirleme performansının otobiyografik belleği ve anı tümseğini beklenen şekilde etkilemediği gözlemlenmiştir.

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Introduction

Life Span Distribution of Autobiographical Memories and the Bump

The lifespan distribution of autobiographical memories constitutes one of the most consistent findings in memory research. It is characterized by three distinctive components, namely the childhood or infantile amnesia, reminiscence bump, and retention (Rybash,1999). Childhood amnesia refers to the relatively few amount of memories from the childhood period, and it is usually thought to end at around 4 years of age (e.g. Bruce, Dolan, & Phillips-Grant, 2000; Multhaup, Johnson, & Tetirick, 2005). Reminiscence bump refers to the unexpectedly high number of memories from between 10 and 30 years of age, relative to other periods of life (e.g. Jansari & Parkin, 1996; Rubin, Rahhal, & Poon, 1998; Rybash & Monaghan, 1999). Although the term reminiscence bump is widely accepted and used in autobiographical memory literature, Rubin and Schulkind (1997) propose to use "the theoretically more neutral term bump" (p. 525). A similar approach will be adopted throughout the present study and the phenomenon in question will be referred to as the bump hereafter. The third component, retention, refers to the higher number of recall for events from the recent years of life and it can best be described by a power function (Rubin, 1982; Rubin & Wenzel, 1996). Among these three components, the present study focuses on the bump component and aims to propose an alternative framework in relation to which the bump can be interpreted, that of source monitoring (Johnson, Hashtroudi, & Lindsay, 1993).

Being one of the defining components of the autobiographical memory distribution, the bump has several unique characteristics. In addition to the consistent emergence of the bump in a typical study on autobiographical recall where the participants are provided with cue-words and asked to report the first memory that

they can recall of (e.g. Rubin & Schulkind, 1997; Rubin, Wetzler, & Nebes, 1986), it has also been observed in several other studies such as those in which people were asked to report their most vivid autobiographical memories, memorable reading experiences, liking for songs, favorite films, and the events that they consider as most important either personally or worldwide (see Rubin, Rahhal, & Poon, 1998, for a review).

Also, in contrast to the other two components of autobiographical recall, that is childhood amnesia and retention, which can be observed uniformly in any age group, the bump is observed almost exclusively in older adults. With participants in or over their fifties the bump can be reliably observed. However, with participants in their forties the bump is not as consistent, and it is difficult to interpret with participants younger than 30 years of age since it may indicate either the bump or the retention components of the typical autobiographical memory distribution (e.g., Rubin & Schulkind, 1997; Rubin et al., 1986).

The only exception is a study that points to the possibility of obtaining the bump with middle-aged adults (Jansari & Parkin, 1996). However in that case, the occurrence of the bump depends on a methodological modification. Reasoning that obtaining the bump depends on the availability of memories from other life periods, Jansari and Parkin (1996) modified the standard procedure of autobiographical recall in a way that would not allow the retention part to shadow the bump. According to their reasoning, the main reason for failing to find the bump in most of the studies was the relatively stronger preference to recall recent memories on the part of middle-aged participants. They asked their participants to exclude the memories from the last 2½ years when cued with a word. With such a methodological modification, the middle-aged participants showed a bump, too. However, the bump

was observed for memories coming from an earlier period compared to the memories which fall within the standard period of the bump.

The pervasive nature of the phenomenon provides a ground for theoretical interest on the subject as well as it leads researchers to propose several accounts to explain the conditions leading to the occurrence of the bump. These accounts mainly differ on which factors they focus in explaining the bump rather than offering radically different explanations. The biological/maturational account offers the life span rise and decline of cognitive abilities and evolutionary explanations as the underlining factors of the bump. The self-memory system (Conway & Pleydell-Pearce, 2000; Conway, Singer, & Tagini, 2004) explanation blends memory processes with identity formation and proposes an account in which the two interact continuously. The cognitive account (Rubin et al., 1998) emphasizes the role of cognitive factors, as the name implies, leading to the bump. Finally, the life-scripts account (Berntsen & Rubin, 2004) shifts the focus onto the cultural factors as being the critical element to explain the bump.

The Biological/Maturational Account

The major argument of the biological/maturational account depends on the life span rise and fall of cognitive abilities and their neural bases. The theory holds that childhood is a period that people are not equipped with an efficient neural and cognitive structure that can allow them to remember the events from this period as well as they can remember the events from a period, such as young adulthood, when they are more fit to do so both in terms of neural and cognitive structure. Another biologically based account approaches the bump in evolutionary terms. In a nutshell, young adulthood, being the optimal period for reproduction, is the period when people can benefit from heightened cognitive functions for mate selection purposes,

hence the increased rate of recall for the events coming from this particular period. However, any account that emphasizes the biological aspect of increased memory performance for the events that fall into the bump period fail to account for other components of the autobiographical recall, especially the occurrence of the bump after a certain age (see Rubin et al., 1998 for more detail).

The Identity Account

Based on Erikson's (1950 as cited in Conway & Pleydell-Pearce, 2000) theory of psychosocial development, the bump is thought to occur as the result of the "major development of identity in late adolescence" (p. 279). According to this account, the period between 10 and 30 years of age, in other words the period marked by the end of adolescence and the beginning of adulthood, is the period during which a person forms his or her life goals and a self concept. Once formed, this self schema which remains active during the later retrieval of autobiographical memories, leads to the preferential retrieval of memories from the period of its formation. Specifically, "highly self-relevant and self-formative events that were experienced during a period marked by the generation of long-term goals remain highly accessible in memory because of their enduring association with the current goals of the working self" (Conway & Pleydell-Pearce, 2000, p. 280). With this basic premise, the self account arrives to cover a wide range of findings, including the unexpected ones (Conway & Haque, 1999; Holmes & Conway, 1999).

In their study with Bangladeshi participants, Conway and Haque (1999) found that the bump showed different patterns for younger and older participants. For younger participants, the bump occurred for the events experienced between 10 to 30 years of age as expected. However, older participants showed two bumps, one similar to the one observed for younger participants and an additional one between

the ages of 35 to 55. Although the occurrence of two distinct bumps does not correspond to the regular pattern of the distribution of autobiographical memories, Conway and Haque (1999) attribute this finding to the characteristics of their sample. Specifically, the period when older participants were between 35 to 55 years of age corresponded to a series of nationally significant events. Accordingly, they accounted for the unusual distribution of autobiographical memories by extending the self account of the bump from individual self to collective self.

In another study, Holmes and Conway (1999) challenged the regularity of the bump by decomposing it at first and interpret their findings within the self account later on. Based on the content of the remembered event, private or public, the bump appeared in slightly different locations. For public events, the bump corresponded to the period when the respondents were between 10 to 19 years of age whereas for private events the bump appeared between 20 to 29 years of age. Contrary to the majority of the findings pointing to the unitary nature of the bump, this two-component pattern seems to challenge the robustness of the phenomenon. However, the explanation provided by Holmes and Conway (1999) emphasizes the correspondence of autobiographical remembering with Eriksonian psychosocial stages and attribute the first component of the bump to "a process of making an external or generational identity with their society" and the second component to "a period when individuals are primarily concerned with the development of intimacy of personal relationships" (p. 30).

A more recent, and revised version of the self account (Conway, Singer, & Tagini, 2004) postulates an episodic memory system which results from the interaction of the working self and the long term self. As it is also implied with the term "working" this account proposes a dynamic process. That is the self definition

and personal goals at a given moment structures autobiographical recall for that moment. Although this revised version of the self memory system does not propose a mechanism for the bump, it can be inferred that the events that constitute the bump are those that are in line with the goals and self definition of the individual at the time of recall.

The Cognitive Account

Considering the robustness of the bump, Rubin, Rahhal, and Poon (1998) proposed a general mechanism by which the bump occurs. In a nutshell, they proposed that novel events followed by a period of stability are remembered best. Extrapolating from experimental studies of memory, they propose that facilitating conditions for retrieval in experimental settings act in a similar way for autobiographical remembering. Accordingly, they identify five beneficial conditions derived from the novelty and stability components of the previous statement. Novelty enhances recall in three ways. First, due to the lack of previous similar instances, novel events are processed more effortfully, therefore remembered better at a later time. Second, novel events are immune to the effects of proactive interference, again because of the lack of previous similar instances. Third, novelty is a source of distinctiveness which adds to the memorability of the event. With respect to stability, there are two beneficial effects. First, stability enhances recall by making the event serve as a prototype of later occurrences of similar events. In this way, the first event becomes repeatedly accessed as part of a retrospective comparison process. Second, stability contributes to the memorability of the event by preparing the ground for the establishment of a stable cognitive structure which serves as cue in later remembering attempts.

Accordingly, the bump is thought to occur as a result of the combined effects of these five factors, as it would be the case for any memory regardless of the period within which they were experienced. The events, which fall into the period characterized by the bump, happen to be the ones that benefit the most from the consequences of such processes. More precisely, the events from these periods are generally novel for the individual, so that they benefit from deeper processing, the lack of proactive interference, and distinctiveness. In addition, this novel experiences are followed by a period of stability during the life course of the individual, therefore benefit from the prototypical attributions made for that event and the schema like structure composed by that event (Rubin et al., 1998).

Similar to previously mentioned studies (Conway & Haque, 1999; Holmes & Conway, 1999) which report unusual curves for autobiographical retrieval and the location the bump within, Schrauf and Rubin (2001) also report a special instance of the bump. In their study with older Hispanic immigrants, the bump is found to correspond to the participants' period of immigration. When reported memories were plotted in terms of their relative distance from the immigration date, the bump showed a peak at year zero. The participants' age at immigration, which ranged from 20 to 35, was a better determinant of the bump as opposed to the usually observed age range within which the bump occurs. Similar to the Conway and Haque (1999) study, they attributed this unusual finding to the nature of the period of immigration. They defined immigration as a period in which people experience novel events and a period followed by a more stable life course, that of settlement. In line with the account proposed by Rubin et al. (1998), they emphasized novelty and stability as the defining features of the bump instead of confining it to a predetermined age range.

A later modification to this account comes from Berntsen and Rubin (2002). In their attempt to account for the rather unexpected finding of the differential distribution of happiest, saddest, involuntary, and most traumatic memories, Berntsen and Rubin (2002) proposed, along with the life-scripts account, several modifications to the explanations provided by other accounts. Regarding the cognitive account, they proposed that negative events are more likely (i) to be rehearsed less due to social censure, (ii) to be followed by life change therefore less likely to allow for the steady period which enhances the rehearsal and memorability of the events of young adulthood, postulated by the original version of the cognitive account, and (iii) to fade more rapidly than positive events therefore lead to a more pronounced recency effect.

In a nutshell, the cognitive account emphasizes the conditions that lead to the observation of the bump rather than its qualitative characteristics. Also, contrary to the explanation provided by the self memory system, the cognitive account emphasizes the characteristics of the memories that constitutes the bump rather than the conditions at the time of recall.

The Life-Scripts Account

Adopting a global approach, the life-scripts account, first proposed by Berntsen and Rubin (2002) to account for the relative positions of happiest, saddest, and most traumatic memories over the autobiographical memory distribution, emphasizes the effects of culturally shared knowledge and practices to account for the bump. In contrast to the previous accounts summarized above, they theorize that life-scripts provide a framework for the events occurring during a person's lifetime not only at the time of retrieval but also while experiencing them and in between the time of the event and its retrieval (Berntsen & Rubin, 2004).They conceptualize life

scripts as being generic, nonpersonal, dealing with cultural expectations, dealing with a fixed temporal order, and representing semantic knowledge.

The life-scripts account originates from the clearly identifiable bump for memories of the happiest and most important events in contrast to its lack for memories of saddest and most traumatic events (Berntsen & Rubin, 2002) as well as from the observation that the distribution of autobiographical memories mimics the possible distribution of events expected to occur during a person's life course (Berntsen & Rubin, 2004), and supported by evidence summarized below.

Life-scripts, by definition, are normative and provide people with culturally accepted norms regarding transitional events that may occur in one's life and the age range that these events are likely to be experienced. In their analysis of anthropological, sociological, and psychological literature on age norms Berntsen and Rubin (2004) showed "(1) more agreement on age norms for transitional events, (2) that more transitional events were expected to occur in the period covered by the bump than outside this period, (3) more agreement on age norms for transitional events that are expected to occur in the period of the bump than outside of this period, and (4) more agreement on age norms for positive than for negative events" (p. 438).

When 20 to 99 year-old adults are asked about when would a hypothetical 100-year-old person have experienced the happiest, saddest, most important, and most traumatic event of his or her life, and felt most in love and most afraid, important and emotionally positive events were agreed upon in terms of the age that they would have been experienced whereas emotionally negative events were not. Also, positive and important events in one's life were predicted to occur during young adulthood whereas negative events in question, saddest, most traumatic, and

felt most afraid, were dispersed in terms of the age range that they were expected to occur.

The third line of evidence provided by Berntsen and Rubin (2004) replicates the findings of the previously mentioned studies by looking from the other end of the life cycle. Specifically, they instructed undergraduates to generate several important events that they would expect to occur in the life of a newborn and asked to indicate the prevalence, importance, age, valence, and specific emotion attributed to the event. Again, it was found out that transitional and positive events in a prototypical life were expected to occur in the bump period.

As it was the case for previous accounts, the irregularities of the bump provide a testing medium for theoretical explanations. However, the short history of the account does not allow for such tests. An alternative approach would be to interpret the results of the previously mentioned studies that report rather unexpected findings. For example, Conway and Haque (1999) identified a second, unexpected bump period between the ages of 35-to-55, which was also a period of nationally significant event. Their interpretation was based on the operations of collective self as opposed to individual self. Another post hoc explanation, in line with the life-scripts account, would emphasize the shared knowledge about the events of that period and its expected significance in the life of a person who have gone through this period.

To sum up, life scripts contribute to autobiographical recall in two major ways. First, they provide a search tool at recall, and second, they enhance the encoding of life script congruent events in several ways. Events predetermined by the life script benefit from the consequentiality attributed to the event even before they are experienced. Life script events also benefit from several forms of external

record keeping, such as diaries and photographs. Related to that, those events are often socially shared ones. Another aspect of life script events is that they deal with life transitions, therefore first time experiences and changes in social identity. The final contribution of life scripts to the script matching events is their assumed importance, therefore heightened emotions at encoding (Berntsen & Rubin, 2004). Benefiting from many, if not all, of these conditions, events that are considered to be part of life scripts consequently lead to the typical distribution of autobiographical memories.

Overall, the life scripts account proposes that rather than operating only at the encoding or retrieval phase of autobiographical memories, life scripts help people to better encode, rehearse and retrieve the events that fall into the bump period.

As reviewed above, the accounts proposed to explain the bump are not mutually exclusive but they emphasize different factors contributing to the bump. However, two of these accounts, the cognitive account and the life scripts account, converge in their emphasis on the subsequent rehearsal of the memories that constitutes the bump. Focusing on this rehearsal component of these two accounts, the present study aims to provide an alternative mechanism that might also be contributing to the bump. Specifically, the present study is built on the idea that the bump may be a special case of flawed source monitoring (Johnson et al., 1993), observed in old age (Glisky, 2001).

Source Memory

The term source memory refers to the "recollection of the episodic source from which a specific item or fact was acquired" (Schacter, Kaszniak, Kihlstrom, & Valdisseri, 1991, p. 559). More broadly, it can be defined using a content and

context contrast and can be thought as any aspect of the context of an event (Johnson et al., 1993).

Several lines of evidence point to the dissociation of source from item memory. A major and extensively studied dissociation between source and item memory concerns age. Younger participants are consistently found to perform better in source memory tasks compared to their older counterparts while item memory seems to be affected by age to a lesser degree (Glisky, Rubin, & Davidson, 2003; Schacter et al., 1991). Another dissociation occurs at the neurological level. Source memory is often associated with frontal lobes whereas item memory is thought to require the involvement of medial temporal lobes (e.g. Glisky, Polster, & Routhieaux, 1995; Mahter, Johnson, & De Leonardis, 1999).

Another major difference between item and source memory originates from the retrieval characteristics of the two. While the former can be conceptualized as the passive retrieval of memories, the latter requires an additional processing of attributing the remembered item to an appropriate source. Source monitoring, as a framework, refers to the processes by which such an attribution can be made and identifies the conditions which enhance or flaw this process (Johnson, et al., 1993; Johnson & Mitchell, 2002). In essence, the previously mentioned dissociations between source and item memory can be considered as the behavioral reflections of these two different processes, retrieval of memories and source attribution processes.

Source Monitoring

Accurate source monitoring depends on three kinds of decisions about the source of a memory. The main one involves discriminating between internal and external sources. An internal source may be a thought or imagination while an external source is the actual experience of an event. Once this differentiation is

made, the next decision is to discriminate either among external sources or among internal sources, depending on the previous decision (Johnson et al., 1993).

Since source monitoring basically involves a series of judgments, several factors that are known to affect judgment processes also affect source monitoring decisions. Additionally, since the judgments to be made concern memories, another factor affecting source monitoring is the characteristics of memories. In short, source monitoring framework proposes that source attributions depend on the combined effects of these judgmental processes and memory characteristics (Johnson et al., 1993).

Parallel to the literature on judgment and decision making, source monitoring decisions benefit or suffer from the judgment type, heuristic or systematic, depending of the decision that it leads to. Phenomenal characteristics of a memory such as vividness, emotional content, or the amount of perceptual detail can be used as heuristics in attributing the source (Johnson et al., 1993). Although most of the time these heuristics lead to the correct matching of the event and the source, under several circumstances they lead to inaccurate source attributions. For example, perceptual similarity between perceived and imagined events (Henkel & Franklin, 1998), semantic similarity between perceived events, or even linguistic labels, assessed by the use of homographs (Geraci & Franklin, 2004), can lead to inaccurate source attributions. Considering the close relationship between decision making processes and source attributions, it is likely that age related changes in judgment and decision making (Sanfey & Hastie, 2000) reflect themselves in source monitoring performance.

Aging and Source Memory

Age is consistently found to be a major factor affecting source memory. A general finding is that young adults perform better in source monitoring tasks than children and older adults (Glisky et al., 2003; Rybash & Hrubi-Bopp, 2000; Schacter et al., 1991). Old age has been found to correlate with impaired source memory performance regardless of the task used as the measure of source memory. Identifying the person who said a particular statement (Mather et al., 1999; Bayen & Murnane, 1996; Rahhal, May, & Hasher, 2002), identifying seen, heard or imagined items (Henkel, Franklin, Johnson, 2000), identifying the modality in which the information was presented (Light, La Voie, Valencia-Laver, Albertson Owens, & Mead, 1992), among others, are source memory measures that old age has been found to correlate with source memory performance.

Neurological Bases of Source Monitoring

Being a correlate of normal aging, frontal lobe function is also found to affect performance in source memory tasks. Furthermore, the contribution of frontal function to source monitoring performance appears to be independent from age. Elderly participants, between the ages of 65 and 87 years old, with a higher level of frontal function as assessed by a battery of neuropsychological tests, were found to outperform their counterparts with a lower level of frontal function in a source memory task but not in an item memory task. Conversely, when they are grouped according to their medial temporal lobe function, the high-functioning group is found to perform better in the item memory task but not in the source memory task compared to the low-functioning group (Glisky et al.,1995).

Another line of evidence for the involvement of frontal lobes in source memory is provided by the studies on frontal lobe patients. For example, in patients

with damage to the prefrontal cortex memory for the source of information is found to be more impaired compared to the memory for the information itself. As opposed to the correct recall of factual information the spatiotemporal context in which the information was acquired was forgotten (Shimamura & Squire, 1987; as cited in Knight & Stuss, 2002). Also, another study carried out with patients with frontal lobe damage, points out that these patients failed to engage in effortful recollection of source information, especially when it was not explicitly available (Rapcsak, Reminger, Glisky, Kaszniak, & Comer, 1999).

Parting from the general finding regarding the involvement of frontal lobes in strategic source monitoring decisions, current literature on source memory and frontal function, focus on the different patterns of prefrontal activation found in different studies of source memory. There is a solid agreement on the involvement of the left prefrontal cortex in source monitoring (Dobbins, Foley, Schacter, & Wagner, 2002; Nolde, Johnson, & D'Esposito, 1998), especially when the reflective demands of the task are complex and require strategic processing (Nolde, Johnson, Raye, 1998). It has also been found that retrieval of specific context information depends on the differential activation of several brain regions as opposed to a general activation of regions known to be involved in item retrieval. Specifically, retrieval of item, location and time information are found to depend on the activation of different brain regions (Nyberg, McIntosh, Cabeza, Habib, & Tulving, 1996). However, this differential involvement of brain regions in source memory tasks deserves a separate discussion and is beyond the scope of this study.

Source monitoring, in short, is found to depend on the frontal lobes and their proper functioning. While current research in the area is on its way to identify specific brain regions involved in source monitoring (Dobbins et al., 2002), the well

established findings on the function of frontal lobes in general and their contribution to source monitoring decisions in particular, provide a proper ground to base the present study.

Frontal Function

The major role attributed to the frontal lobes, more specifically to the prefrontal cortex, is the implementation of top-down or executive processes. Regarding the involvement of frontal lobes in episodic memory, Ranganath & Knight (2002) propose that rather than being fundamental for episodic encoding or retrieval, prefrontal cortex plays a supervisory role in episodic memory. Accordingly, frontal lobes are thought to enhance memory encoding and subsequent memory attributions through the higher level cognitive processes that they implement.

The idea that episodic memory benefiting from the strategic operations of the frontal lobes parallels with the involvement of the frontal lobes in source memory tasks, especially those involving monitoring processes. The previously mentioned dissociations between source and item memory also point to the distinct roles frontal lobes and medial temporal lobes, traditionally associated with memory functions, in episodic memory retrieval.

As mentioned several times up to this point, three areas that the literature on frontal function focuses coincide with the aims of the present study. Specifically, the findings on the role of frontal lobes in autobiographical memory, source memory, and aging, as a whole, provide the rationale for the present study.

Episodic memory, which can also be treated as a molecular component of autobiographical memory, has been associated with frontal lobes (Nyberg, 1998)

even the debate on the nature and on the fractionation of its contributions still continues (Fletcher & Henson, 2001).

In his review of prefrontal activations reported in studies of episodic and autobiographical memory, Gilboa (2004) argues that extrapolating from laboratory studies of episodic memory might not always reflect the processes that take place in autobiographical recall. Although the areas of activation observed in episodic memory studies mostly match with those observed in autobiographical memory studies, the review also points to the differences. Specifically, ventromedial prefrontal cortex is mentioned to be involved in autobiographical recall whereas it is not found to be active in other modes of episodic recall. Consequently, autobiographical memory is proposed to be a distinct memory system that constitutes declarative memory together with semantic and episodic memory. Within this system ventromedial prefrontal cortex is seen to be involved in (i) processing of self-related information; (ii) decision making under conditions of uncertainty when multiple possible answers are available and (iii) memory control processes providing a 'feeling of rightness' (Gilboa, 2004, p.1345).

As mentioned previously, the involvement of frontal lobes in episodic memory tasks in general and in source monitoring decisions in particular is repeatedly documented both in behavioral and neuroimaging studies (Glisky et al., 1995; Dobbins et al., 2002). As it concerns the aging literature, age-related decline in source monitoring performance follows the same timeline with the decline of frontal functions. However, it is also documented that separating aging from the decline of frontal functions (e.g., Glisky et, al, 2003; Butler, McDaniel, Dornburg, Price, & Roediger III, 2004) by grouping older individuals on the basis of their frontal lobe functioning accentuates within group differences in older adults. Nonetheless, on a

more general level, both physiological and behavioral findings (Reuter-Lorenz, 2000) point to the deterioration of the frontal lobes, and consequently, of the functions attributed to them as a correlate of normal aging.

Cognitive Aging

In light of the findings reviewed above, cognitive aging appears to be the catalyst through which the above mentioned domains assemble. In all three domains, autobiographical memory, source memory and frontal function, we can observe changes, if not decline, as people grow older. Overall, the effects of aging on cognition can be summarized by making use of two contrasts originating from essential questions of the area. What are the changes that take place as people grow older? How do these changes manifest themselves? The shortest answer to these questions points both to the physiological and behavioral changes that take place at a general level as well as in a selective manner.

A general look to the cognitive aging literature reveals two main groups of theorizing (Grady, 2001). At the physiological level, aging is accompanied by several neurological changes. A linear decrease in cerebral volume, neuronal changes such as age-related attrition or shrinkage of neurons, problems in neuronal connectivity, and reduction in regional cerebral blood flow are general changes observable in the aging brain (Raz, 2000). All these changes are found to affect frontal lobes more severely than they affect other parts of the brain. This is also supported by the evidence provided by behavioral studies, some of which summarized above, that suggest more impairment in performance in tests that rely on frontal function. In opposition to the frontal theory of aging (Perfect, 1997), two lines of evidence are presented. One emphasizes the fractionation of frontal lobes in terms of processes they are involved while the other favors the involvement of

networks of brain areas rather than any one region acting independently (Greenwood, 2000). So, the major criticism of frontal theory of aging is that it may be too narrowly focused (Grady, 2001).

At the behavioral level, age-related changes in cognitive abilities are observed in varying degrees in several domains. Major age-related changes are observed in tests of free recall, source memory, working memory, and prospective memory rather than other types of tasks (Craik & Grady, 2002). However, these differential changes are attributed to two general factors, "generalized age-related slowing and reduction in working memory" (Raz, 2000, p. 42), affecting cognitive abilities in a selective manner. The major shortcoming of this line of theorizing is that is does not always receive support from neuroimaging studies. Both reduced and increased response times are found to correlate with increased activity in the prefrontal regions depending on task type, regardless of the age of participants (Grady, 2001).

Central to the present study, age-related changes in memory are found to be more severe for some types of tasks compared to others. In normal aging, performance in memory tasks that require strategic processing is found to be impaired more than the performance in memory tasks that do not require strategic processing. For example, it has been repeatedly found that older people perform better in recognition tests as opposed to free recall tests. This difference in memory performance is attributed to different levels of strategic demands (i.e., how much planning, organization, evaluation, or manipulation is required) of the task. Similarly, tests of list discrimination, frequency, and temporal ordering are found to be the memory tests that presents difficulties to older adults due to the amount of

strategic processing they require (see Prull, Gabrieli, & Bunge, 2000 for more detail).

When it comes to the recall of autobiographical memories in old age, Rubin (2000) presents several studies that points out to an increased number of memories coming from adolescence and young adulthood compared to other periods of a person's lifetime. In addition, these memories that show a bump in these periods were not rated different compared to those coming from other periods, in terms of importance, vividness, emotionality, novelty, or the number of times that the memory was rehearsed. Since the findings on autobiographical recall in old age are reviewed in depth in previous sections, it seems sufficient to mention them as a reminder.

These different lines of evidence, although emphasizing different aspects of aging and different mechanisms involved in, all share the common finding of frontal lobe involvement in the process whether as a central contributor or not. Regardless of the underlying causes proposed to explain cognitive aging, the patterns observed in studies of cognitive aging converge in providing the rationale for the present study.

Cognitive Aging as a Background to the Bump

Although age related changes in source memory and frontal function are well documented (e.g. Glisky, 2001 ;Trott, Friedman, Ritter, Fabiani, & Snodrass, 1999), the age related change in autobiographical memory distribution, namely the occurrence of the bump only after a certain age, does not fit within the cognitive aging framework.

Nevertheless, with a molecular perspective, the bump can easily be seen as another byproduct of cognitive aging. In addition to the account proposed by Rubin

et al. (1998), source monitoring can be seen as another factor contributing to the bump. In fact, Rubin and Shulkind (1997) commented on the bump as "it appears that memories in the bump seem just like memories from other periods of life, there are just more of them" (p. 533). However, they did not propose a mechanism accounting for that "just" quantitative difference. Here, source monitoring framework can offer a useful mechanism, that of the discrimination between external and internal sources. Additionally, the diminishing source monitoring performance as one ages is consistently found to be accompanied by lower frontal functioning as measured by neuropsychological tests and imaging techniques. In the light of the studies reviewed above, there appears to be a continuum, with life span distribution of autobiographical memories at one end and frontal lobe involvement in episodic memory at the other end. The present study is an attempt to strengthen the links within this continuum by emphasizing the possible contributions of source monitoring processes to autobiographical recall.

More specifically, the rationale behind proposing such a correspondence between the bump and source monitoring follows from two observations, one methodological one correlational. From the methodological viewpoint, a typical study of autobiographical recall involves generating memories cued by a word and subsequently dating them. This "when?" question represents a source memory task par excellence since it requires the respondent to refer back to the temporal source of the event. It also involves a related source monitoring decision, the internal-external discrimination in the sense that the person might refer either to the actual occurrence of the event or to a subsequent remembering episode of that event. The correlational interpretation of the findings from both domains, that of the bump and source monitoring, leads to the common denominator of these two domains, old age.

Additionally, such a proposition fits well into several accounts proposed to explain the bump although it seems to be better integrated with one of them, the cognitive account.

As suggested by Rubin et al. (1998), the five factors related to novelty and stability contribute to the retrievability of an event and those factors also characterize the bump period. So, the events from the bump period are the ones most likely to be remembered, regardless of the age of the rememberer. However, one of the most consistent findings on the bump is that it can be reliably and almost exclusively observed in older adults. This picture requires us to consider the combined effects of the cognitive account and the source monitoring processes. Due to the factors specified by Rubin et al. (1998) events from the bump period are the most frequently and easily retrieved ones, internally. Also, due to the enhancement of these memories and frequent access to them, when asked to report autobiographical memories, people tend to report the events which constitute the bump. However, they tend to do so when they are older but not younger. Coupling this characteristic of the bump with the relatively impaired source memory in older people suggests that the bump might indicate the relative difficulty experienced by older people in discriminating the origin of their experiences, actual events or later remembering episodes concerning those events.

The major limitation of the proposed mechanism for autobiographical recall in older adults is that it is not directly testable. However, several experimental studies provide the support for the existence of a similar mechanism, at least on a micro level. “If cueing conditions selectively favor revival of one or more prior instances of recollection over revival of the event itself, that memory information may be mistaken as a memory of perceptual experience (i.e., the individual thinks

s/he is remembering an actual experience but is really reviving memories of prior recollections of that experience rather than memories of the event itself)" (Arnold & Lindsay, 2002, p.528).

Designed to provide a discussion point for the recovered memory debate, a study by Parks (1999) points to the possibility of forgetting a previous remembering episode concerning an event, even if it took place minutes before the second attempt to remember the same event. In this study, participants were asked to remember events from their childhood or adolescence. Then, in the second phase of the experiment, which directly followed the first one, they were asked how recently did they remember the events that they mentioned remembering during the first phase. The majority of the participants, event though it was made explicit that they had the option to mention "during this experiment" as an answer, failed to report that they remembered the given event during the experiment, in the first phase. Rather, on average, they reported to have remembered the events 25 weeks ago.

Similar findings are reported in a series of studies by Arnold and Lindsay (2002; 2005). In both studies participants were given homographs as target words and cue-words to provide the context and tested 2 times after studying the words. In total, they were tested with studied context words, other context words, context sentences that imply the meaning, and with no cue at all in both tests. Additionally, in the second test, they were asked to report whether they remembered the target word during the first test. Considering both studies together, the major condition that is found to lead to the forgetting of prior recall is different cueing in both tests. Also, in the latter study (Arnold & Lindsay, 2005) the participants were asked to rate how confident they were in their incorrect prior recall judgments. Again, the participants

were more confident in their incorrect answers when context words were different than those used to study the target words.

Another recent study (Henkel, 2004) provides more direct evidence regarding the mechanism above proposed to operate at autobiographical recall. In three separate experiments, the effects of repeated and prolonged attempts at remembering either by free or forced recall on source memory decisions were investigated. Collectively, the results indicated that repeated memory tests decreased source accuracy, physical resemblance or conceptual closeness between items to be remembered increased source misattributions, and accurate source decisions in later remembering can be ensured by making participants also remember the source at their every attempt to remember the item.

Although indirectly, the findings reviewed above converge in providing the hypotheses put forward in the present study. The present study aims to investigate the possible relations among autobiographical recall, source monitoring performance, and neuropsychological tests of frontal functions as they relate to aging and life span distribution of autobiographical memories. As it has been reliably observed in previous studies, life span distribution of autobiographical memories is expected to show its characteristic pattern with three distinctive components, that is, childhood amnesia, bump and retention especially for older participants. Similarly, source monitoring and frontal function are expected to replicate the consistent findings previously reported. That is, source monitoring performance is expected to correlate with age and tests of frontal function. Specifically, younger participants are expected to perform better on source monitoring tasks and to score higher on the tests assessing frontal function compared to older participants. However, the major prediction of the present study involves the bump and source monitoring

performance. Autobiographical recall, as assessed in the present study, was conceptualized as a source monitoring task which requires the participants to access the temporal source of a past event. Accordingly, the bump in the autobiographical memory distribution could be seen as a manifestation of flawed source monitoring in old age. Combined with the previous predictions of the present study, this conceptualization leads to the main hypothesis of the study. Specifically, poorer performance in the source monitoring task is expected to be accompanied by lower scores in neuropsychological tests assessing frontal function and by an accentuated bump in the autobiographical recall curve regardless of age of the participant.

Method

Participants

A total of 56 participants (35 females (62.5%), 21 (37.5%) males) took part in the study. The age distribution of the participants is shown in Table 1.

Table 1

Age Distribution of the Participants

AGE	n	%	Mean	Median	SD
20-39 (Young)	12	21	30.00	30.00	6.35
40-59 (Middle Aged)	16	29	51.69	52.50	5.16
60+ (Old)	28	50	71.36	71.00	7.58
Total	56	100	56.88	59.50	17.77

The participants were accessed through convenience sampling. The youngest participant, between the ages of 20 and 25 (n=3), were Boğaziçi University undergraduates who participated to the study for course credit while the oldest ones

(over 60, n=28) are contacted either through the retirement homes that they reside in or through their families and participated to the study voluntarily. The participants were screened for several conditions that may interfere with their performance. As a result, the final sample consisted of individuals aged between 20 to 89 years, who are high school or college graduates, who did not go through a major surgical operation within last year, and who were not on medication for a psychological or neurological condition at the time of study.

Materials

Autobiographical Recall

A total of 10 cue-words were used for autobiographical recall. The words were selected randomly from the list of words used previously in an autobiographical memory study conducted with a Turkish sample. For each memory generated in response to cue-words, the participants were asked to provide the date of the event, and how much they thought about the event (i) during their lifetime (ii) within last year.

Source Monitoring Task

The stimuli for the source monitoring task consisted of black and white drawings of everyday objects (Appendix C). The drawings were selected among those used for a picture naming study in seven languages (Bates, D'amico et al., 2003). The pictures and related data are also publicly available at the study's website at http://www.crl.ucsd.edu/~aszekely/ipnp/7lgpno.html.

The pictures used in the study part of the source monitoring task of current study were selected based on the characteristics of their Turkish translations and their visual complexity measure also available at the study's website. Regarding the translations of the picture names, there were two criteria that the stimuli should

meet. The translated names should not be shorter than four and longer than six letters. They should also be neutral words in terms of emotional valence. To meet this second criterion, the pictures selected for the study were checked against the list of positive, negative and neutral Turkish words in terms of emotional valence (Er, 2003) and only those stated in the list of neutral words were selected for the final set.

The final set of pictures (see Appendix C) used in the study were printed on 8.5x11 cm cards and manually presented to the participants each for 3 or 5 seconds depending on the participant's age.

Tests of Frontal Function

Two neuropsychological tests were used to assess frontal function. One was the Turkish version of the Stroop Test (Karakaş, 2004), which was in turn, a combined version of the original Stroop Test and the Victoria Form (Spreen and Strauss, 1991; Stroop, 1935, as cited in Karakaş, 2004). The other test used to asses frontal function was the Wisconsin Card Sorting Test (WCST). More detail on the administration of these two tests is provided by Karakaş (2004). Also specific administration instructions used in the present study are presented in Appendix B.

Procedure

All participants were interviewed individually. The interviews lasted 1 to 2 hours long depending on the participant's pace. First, all participants were asked to generate autobiographical memories in response to cue-words, then to answer several questions about those memories. Following the autobiographical recall section, they engaged in the source monitoring task and received the neuropsychological tests of frontal function. The order of these two tasks, as well as the order of the two tests of frontal function was counterbalanced across participants.

Autobiographical Recall

In the autobiographical recall section of the study, the participants were asked to generate memories in response to 10 cue-words. They were instructed that they may report any memory that the cue-word reminds them first. In addition, they were also presented with several criteria that the memories they report should meet. They were told that the memories could come from any period of their life excluding last one year. Also, they were specifically reminded that the memories they will be reporting could be of any length or importance as long as they were able to tell the event apart from other resembling events or habits. The cue-words are presented to the participants in a random order. For each memory that the participants generated they were also asked to date the event, and to rate it on two dimensions in a five-point scale ranging from "not-at-all" to "very frequently. Specifically, they were asked about how much they thought or talked about the event overall, and how much they thought or talked about the event within last year. These two questions were intended to provide an index of the later remembering episodes concerning a given event.

However, several participants failed to report a total of 10 memories. In such cases, they were probed and given more time to think. In cases where they still could not come up with a memory to report, they were presented with the next cue-word and asked about the omitted word once again at the end of the section. If a participant failed to report a memory for more than 3 cue-words the interviewer did not proceed to the source monitoring and frontal function sections of the study. So, data from the participants who responded at least to 7 cue-words out of 10 and who reported at least 7 memories are included in the final analyses.

Source Monitoring Task

In the source monitoring task, participants were asked to differentiate among seen and imagined items as well as to identify the study period that they encountered a given item. The source monitoring task consisted of two blocks of study. In the first block the participants were presented with the 24 critical items in succession. Each picture was be shown for 3 seconds and the participants were asked to read aloud the names printed above then to attend to the picture below. For the older group, the presentation of an item lasted 5 seconds. In the following block, the participants were asked to imagine 16 of the previously presented items either once or three times. The remaining 8 items were presented just once during the first block. However, filler items were dispersed among imagery trials in order to prevent the participants to lose interest in the task. In sum, there were 8 items that the participants saw once, 8 items that they saw once and imagined once, and 8 items that they saw once and imagined three times, and a total of 24 filler items not presented in the first study block.

Following the presentation of the items and imagery trials the participants were first asked to recall the initial 24 items, then were given a recognition test along with questions asking about the source of the items. More precisely, for each correctly recalled item as well as for the remaining items in the recognition test, the participants were asked whether they “only saw the item”, “only imagined the item”, “both saw and imagined the item”, or “neither saw nor imagined the item”. Both the recall and the recognition tests were carried out using the names of the items instead of the actual pictures. The participants were then asked for the temporal source of the item. Namely, they were asked to report whether they encountered a given item “only in the first block of study”, “only in the second block of study”, “both in the

first and the second blocks of study", or "neither in the first nor in the second blocks of study".

Tests of Frontal Function

Following the source monitoring task, the participants were administered the neuropsychological tests of frontal function. However, considering the length of the study, the order of these two parts of the second session, source monitoring task and neuropsychological tests, were counterbalanced across participants in order to prevent any effect that may originate from fatigue or boredom.

Results

In line with the design of the present study, the results are presented in four sections. First, the results concerning autobiographical recall are presented, then, those of the source monitoring task, and those of the tests of frontal function. Finally, data from these three components of the present study are analyzed in relation to each other and the results are presented in the fourth section.

Autobiographical Recall

The data on autobiographical recall was analyzed by grouping the participants into 3 age groups, young (20-39), middle aged (40-59), and old (60-89). The following analyses were carried out using this split. For each age group, a one-way ANOVA was performed to see whether the cue words were different in terms of the age of the memories generated. Descriptive data on the age of the events are presented in Table 2. For the young group, there were no significant difference among memories in terms of how old they were ($F(9,109) = 1.07$, $p>.05$, $\eta^2 = .81$). However, both for the middle aged ($F(9,145) = 2.38$, $p<.05$, $\eta^2 = .13$) and old

($F(9,253) = 2.06$, $p<.05$, $\eta^2 = .07$) participants the word "uçurtma" (kite) was found to produce older memories than the word "anahtar" (key).

When the same analyses were performed using the age of the participants at the time of the event as the dependent variable a similar pattern emerged. For the young group (20-39) there were no difference among different cue-words ($F(9,109) = 1.69$, $p = .10$, $\eta^2 = .12$). On the other hand, for the middle aged (40-59) ($F(9,145) = 2.05$, $p<.05$, $\eta^2 = .11$) and old ($F(9,253) = 2.19$, $p<.05$, $\eta^2 = .07$) participants there were a significant difference between two cue words in response to which the memories were generated. Memories of events reported in response to the cue-word "uçurtma" (kite) compared to the cue-word "anahtar" (key) were those experienced when participants were significantly younger.

The age distribution of autobiographical memories is also graphically presented in Figure 1 for each age group.

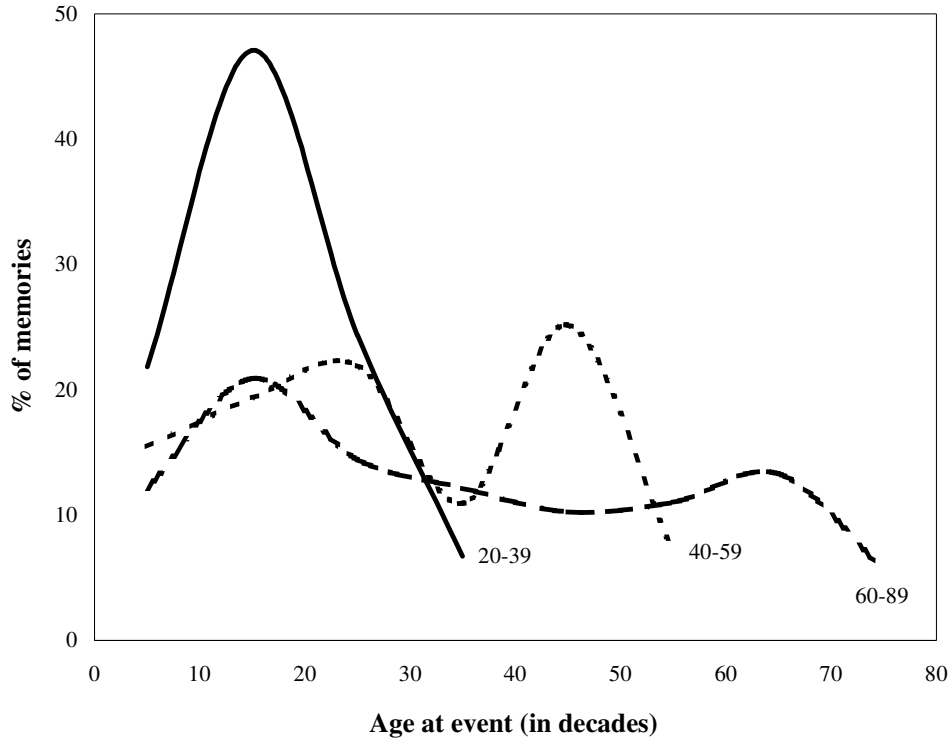

Figure 1. Distribution of age at event broken down by age at retrieval

Table 2

Reported Age of the Event

Age of the Participants		Cue-Words									
		Kiraz	Gerdanlık	Toprak	Reçel	Uçurtma	Makas	Gül	Anahtar	Sandık	Ördek
20-39 (Young)	n	12	11	12	12	12	12	12	12	12	12
	Mean	17.08	10.27	10.75	13.08	18.25	13.17	9.92	14.42	15.25	13.00
	Median	16.00	10.00	6.50	9.00	17.00	7.50	8.00	14.50	11.00	12.50
	SD	7.79	5.75	9.32	10.65	9.55	10.70	8.62	9.46	10.90	8.87
40-59 (Middle Aged)	n	16	14	16	15	14	16	16	16	16	16
	Mean	25.38	25.79	27.00	20.13	34.36	28.81	20.06	13.75	24.63	23.44
	Median	28.00	25.50	30.00	16.00	36.00	33.00	24.50	8.50	27.50	16.00
	SD	16.00	10.98	13.18	12.49	13.07	14.53	12.15	13.69	14.78	17.97
60+ (Old)	n	28	24	24	27	27	25	27	27	27	27
	Mean	38.79	37.25	43.33	34.81	45.33	39.84	29.81	25.04	36.96	35.33
	Median	36.50	36.00	50.50	35.00	56.00	43.00	32.00	16.00	40.00	44.00
	SD	23.80	20.25	22.87	21.42	22.36	16.33	17.13	24.52	20.34	23.55
Total	n	56	49	52	54	53	53	55	55	55	55
	Mean	30.30	27.92	30.79	25.91	36.30	30.47	22.64	19.44	28.64	27.00
	Median	24.00	25.00	30.00	23.50	35.00	31.00	21.00	12.00	29.00	20.00
	SD	21.02	18.77	21.88	19.41	20.75	17.90	16.16	19.77	19.06	21.32

Table 3

Reported Age of the Participant at the Time of the Event

Age of the Participants		Cue-Words									
		Kiraz	Gerdanlık	Toprak	Reçel	Uçurtma	Makas	Gül	Anahtar	Sandık	Ördek
20-39 (Young)	n	12	11	12	12	12	12	12	12	12	12
	Mean	12.92	20.55	19.25	16.92	11.75	16.83	20.08	15.58	14.75	17.00
	Median	13.50	22.00	18.00	15.00	11.00	14.50	18.00	16.50	15.00	13.50
	SD	3.18	6.27	10.14	9.56	5.41	8.79	7.30	6.93	7.30	9.34
40-59 (Middle Aged)	n	16	14	16	15	14	16	16	16	16	16
	Mean	26.31	25.79	24.69	32.13	18.14	22.88	31.63	37.94	27.06	28.25
	Median	22.50	23.50	24.00	40.00	13.50	19.00	29.50	44.50	23.50	32.00
	SD	17.16	11.29	15.29	16.15	11.73	14.77	14.36	14.64	16.29	15.66
60+ (Old)	n	28	24	24	27	27	25	27	27	27	27
	Mean	32.57	34.17	27.71	36.33	25.85	31.64	41.63	46.11	34.22	35.81
	Median	32.00	26.50	20.50	35.00	13.00	31.00	34.00	52.00	31.00	30.00
	SD	22.33	18.87	18.56	21.51	23.43	18.38	17.63	21.10	21.04	23.97
Total	n	56	49	52	54	53	53	55	55	55	55
	Mean	26.57	28.71	24.83	30.85	20.62	25.64	34.02	37.07	27.89	29.51
	Median	16.50	24.00	22.00	28.50	12.00	21.00	29.00	41.00	23.00	26.00
	SD	19.65	15.69	16.05	19.35	18.69	16.51	17.08	20.67	18.88	20.44

As a simple test of the bump, percentage of memories coming from the bump period (10-to-29) was compared with the percentage of memories coming from the following 20 years long period. In order to ensure that all the participants had lived through both periods, this analysis was only performed with the data coming from old participants. For this age group, the percentage of memories coming from 10-to-29 years period (M = 35, SD = 17) was significantly higher than the percentage of memories coming from the percentage of memories coming from 30-to-49 years period (M = 22, SD = 13; $t(27) = 2.96$, $p<.01$). Middle aged participants, however, had not all lived through the 20-year period following the bump. To see whether the distribution autobiographical memories of the middle aged participants showed a bump, the percentage of memories coming from 10-year periods were compared. For this age group, the percentage of memories coming from between the ages of 10 to 19 (M = 19, SD = 19) was not significantly different from the percentage of memories coming from between the ages of 20 to 29 (M = 22, SD = 13; $t(15) = .46$, $p>.05$), while the percentage of memories coming from the following decade (M = 11, SD = 9) was significantly lower than the percentage of memories coming from between the ages of 20 to 29 ($t(15) = 2.73$, $p<.05$).

The reported memories were also investigated in terms of participants' ratings of thinking about the event. Specifically, the participants were asked about how much they had thought about the event (i) after it happened till the day of reporting the event (ii) within last year. From all the memories that they provided the ratings for, a mean score was computed for each participant and the three age groups were compared using these mean scores. Descriptive data on the mean ratings of how much that the event was thought about is presented in Table 5. While participants in the old group reported having thought about the memories that they

reported more than the participants in the young and middle aged groups in total ($F(2,53) = 11.69$, $p<.01$, $\eta^2 = .31$), their ratings on how much that they thought about the memories within last year were significantly different from those of the participants in the young group ($F(2,53) = 5.27$, $p<.01$, $\eta^2 = .17$).

Table 4

Reported Ratings of How Much That the Event Was Thought About

Age of the Participant		Thought about the event / Total	Thought about the event / Last year
20-39 (Young)	Mean	2.34	1.63
	SD	0.43	0.31
40-59 (Middle Aged)	Mean	2.65	1.92
	SD	0.52	0.47
60+ (Old)	Mean	3.12	2.19
	SD	0.51	0.59

The ratings for the events falling into the bump period were also analyzed separately for each age group. Within the young group (20-39), in terms of how they thought about the event after it happened, there were no significant difference between the events falling into the bump period ($M = 2.46$, $SD = .47$) and those that do not ($M = 2.08$, $SD = .77$, $t(10) = 1.65$, $p>.05$). Similarly, the memories coming from the bump period ($M = 1.56$, $SD = .30$) were rated as being equally thought about within last year as the memories coming from other periods ($M = 1.49$, $SD = .61$, $t(10) = .35$, $p>.05$). Middle aged (40-59) participants reported that they thought about the memories coming from the bump period ($M = 1.53$, $SD = .52$) less than they thought about the memories coming from other periods ($M = 2.23$, $SD = .68$) within last year ($t(15) = 3.70$, $p<.01$). However, in total, they reported that they thought about the memories coming from the bump period ($M = 2.47$, $SD = .75$) and the memories coming from other periods ($M = 2.84$, $SD = .78$) equally ($t(15) = 1.31$,

$p>.05$). When it comes to the participants in the old (60 and over) group, they reported that they thought about the memories coming from the bump period and those coming from other periods equally both in total ($M = 2.90$, $SD = .82$ vs. $M = 3.19$, $SD = .60$); $t(27) = 1.83$, $p>.05$) and within last year ($M = 1.97$, $SD = .73$ vs. $M = 2.25$, $SD = .70$; $t(27) = 1.89$, $p>.05$).

Regarding the autobiographical memory distribution, the bump was observed both for the middle aged (40-59) and old (60 and over) group. While the percentage of memories coming from the period of 10-to-29 years of age was significantly higher than the percentage of the memories coming from the period period of 30-to-49 years of age for the old participants, the bump for the middle aged participants appeared at between 20-to-29 years of age. Regarding the ratings of how much the events were thought about, participants in the old group reported thinking about the events less than the participants in two other groups did both in total and within last year. When these ratings were analyzed according to the age of the participants at the time of the event, young, middle aged, and old participants showed different patterns. While young participants reported having thought about the memories coming from the bump period and those that do not equally, both in total and within last year, middle aged participants reported that they thought about the memories coming from the bump period less than the remaining ones, both in total and within last year. Old participants, on the other hand, reported that they thought about the memories coming from the bump period less than the remaining ones only within last year.

Source Monitoring

In the testing part of the source monitoring task, there were five groups of items that the participants were asked about the source. They consisted of the items

presented in the first list, that is items seen once (A), items seen once and imagined once (B), and items seen once and imagined three times (C), filler items presented in the second list, that is items imagined once, and items never presented. Source monitoring performance was assessed based on the items seen at least once. In other words, all analyses for the source monitoring task were performed on the basis of the items presented in the first list. Source monitoring performance, similar to autobiographical recall, is analyzed for each age group separately. Following recall, the participants were asked to specify the source of the item. They were required to make two decisions. One was about either they have seen or imagined the item, hereby referred to as the internal-external source recognition, and the other was about specifying in which list they have encountered the item, hereby referred to as temporal source recognition. Descriptive statistics on these three measures are presented in Table 5.

To have a detailed look to the differences among age groups, word groups, and task type, a series of one-way ANOVA's were performed. For the young group, that is 20-to-39 year-olds, recall performance was found to depend on the item type that is whether an item is seen once, seen once and imagined once, or seen once and imagined three times ($F(2,33) = 15.83$, $p<.01$, $\eta^2 = .49$). Items in group C had a significantly higher recall rate than the items in groups A and B. For the middle aged group, that is 40-to-59 year-olds, ($F(2,45) = 21.55$, $p<.01$, $\eta^2 = .49$) and the old group, that is participants over 60, ($F(2,81) = 69.16$, $p<.01$, $\eta^2 = .63$) recall performance was also found to depend on item type. However, for these two groups, the recall rates of all three types of items were significantly different from each other. When the age groups were compared in terms of correct recall rate, a significant difference emerged only for items seen once ($F(2,53) = 6,12$, $p<.01$, $\eta^2 =$

.19) and total recall rate ($F(2,53) = 5,67$, $p<.01$, $\eta^2 = .18$). Participants in the young group recalled significantly more items seen once than participants in the old group. They also recalled more items in total, compared to both other groups.

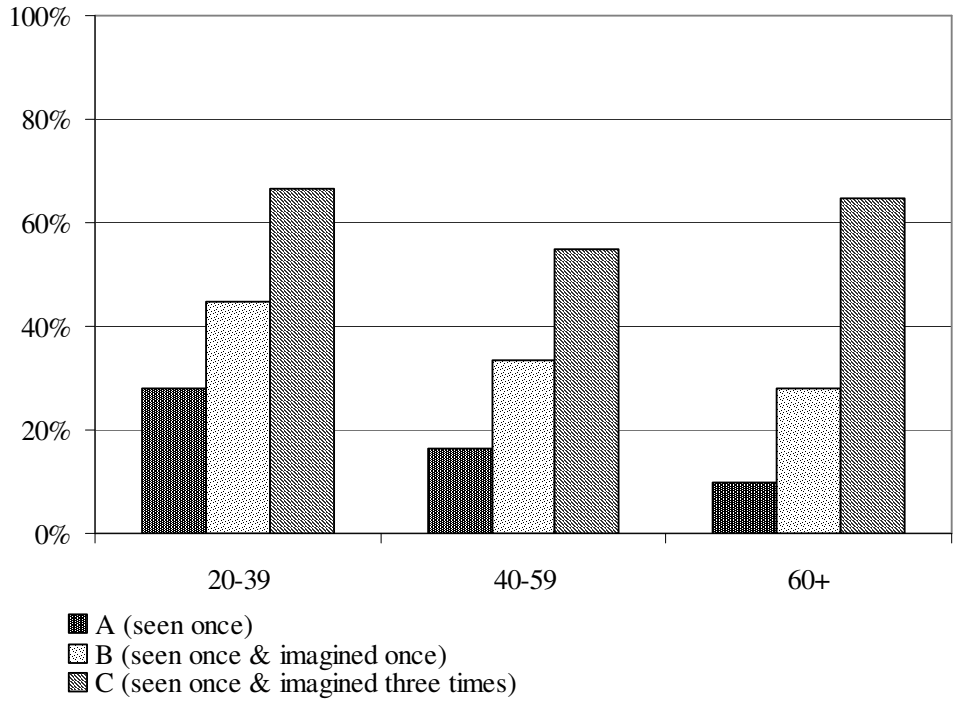

Figure 2. Correct recall by age group and item type

For each age group, the rate of correct internal-external source recognition was found to be sensitive to item type. Young ($F(2,33) = 11.30$, $p<.01$, $\eta^2 = .41$), middle aged ($F(2,45) = 6.15$, $p<.01$, $\eta^2 = .22$), and old ($F(2,81) = 6.47$, $p<.01$, $\eta^2 = .14$) participants were found to have significantly lower rates of correct internal-external source attribution for items seen once and imagined once compared to items seen once and items seen once and imagined three times. However, performance levels of participants in different age groups were not found to differ in this task as a function of their age.

Table 5

Free Recall and Source Monitoring Scores Broken Down by the Age of the Participants

		Recall				Internal - External Source Recognition				Temporal Source Recognition			
		Total	A	B	C	Total	A	B	C	Total	A	B	C
20-39 (Young)	n	12	12	12	12	12	12	12	12	12	12	12	12
	Mean	11.17	2.25	3.58	5.33	16.92	5.92	4.00	7.00	15.42	4.00	4.67	6.75
	SD	1.99	1.49	1.62	0.78	3.18	1.51	2.13	0.74	3.58	1.86	1.50	1.14
40-59 (Middle Aged)	n	16	16	16	16	16	16	16	16	16	16	16	16
	Mean	8.38	1.31	2.69	4.38	14.31	5.44	3.13	5.75	12.94	3.31	3.88	5.75
	SD	3.20	1.35	1.08	1.50	5.40	1.90	2.22	2.75	3.94	2.18	1.93	2.24
60+ (Old)	n	28	28	28	28	28	28	28	28	28	28	28	28
	Mean	8.21	0.79	2.25	5.18	14.96	5.79	3.68	5.50	10.79	3.00	2.86	4.93
	SD	2.53	1.00	1.86	1.28	4.87	1.79	2.74	2.50	5.12	2.18	2.70	2.48

A: items seen once

B: items seen once and imagined once

C: items seen once and imagined three times

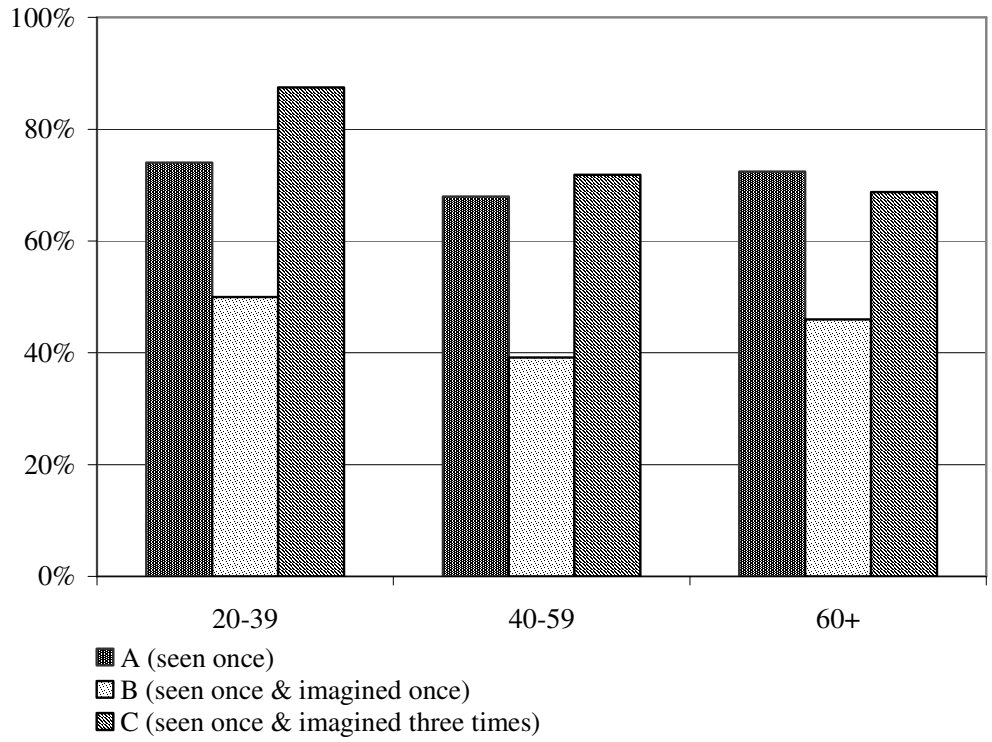

Figure 3. Correct internal-external source recognition by age group and item type

Item type was found to affect temporal source recognition for every age group. Young ($F(2,33) = 10.60$, $p<.01$, $\eta^2 = .39$), middle aged ($F(2,45) = 5.80$, $p<.01$, $\eta^2 = .20$), and old ($F(2,81) = 6.20$, $p<.01$, $\eta^2 = .13$) participants were found to have a higher rate of correct temporal source attribution for items seen one and imagined three times compared to items seen once and items seen once imagined once. The only significant age difference in this task was found for the total number of correct responses ($F(2,53) = 4.57$, $p<.01$, $\eta^2 = .15$). The rate of correct temporal source attribution was significantly higher for young participants compared to old participants.

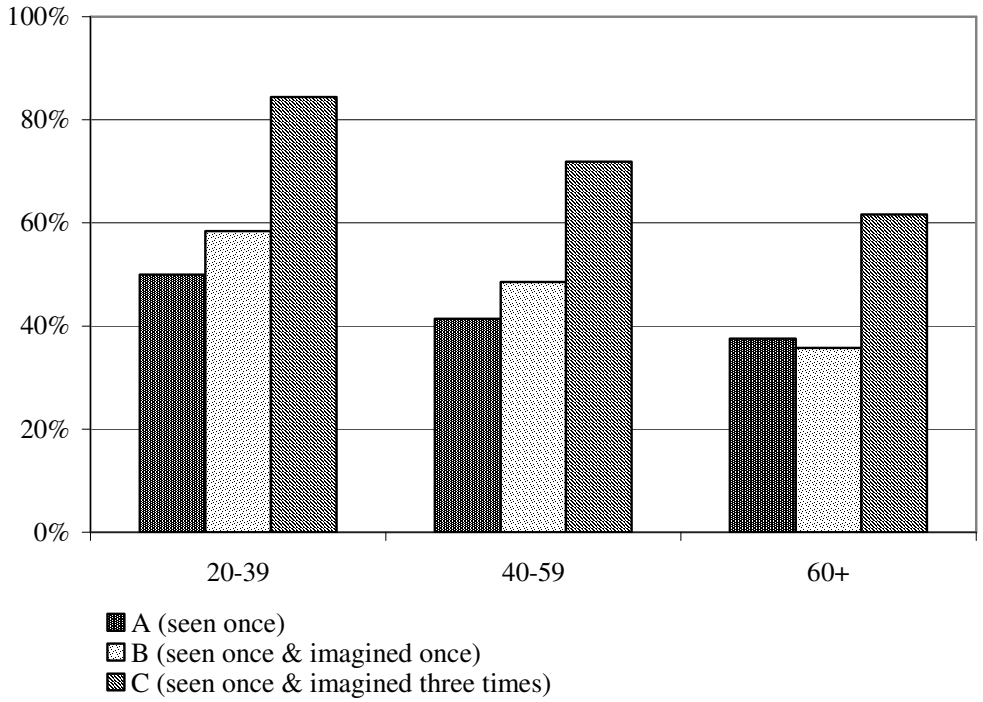

Figure 4. Correct temporal source recognition by age group and item type

Attributing the lack of age differences in source monitoring tasks to sample size, young and middle aged groups were combined and contrasted with the old group with an independent samples t-tests. While there results stayed the same for recall and internal-external source monitoring performance, age is found to affect temporal source monitoring for items seen once and imagined once ($t(54) = 2.23$, $p<.05$), and items seen once and imagined three times ($t(54) = 2.12$, $p<.05$).

Tests of Frontal Function

Two scores were obtained to asses the frontal function, one was the number of categories achieved from the WCST, the other was the time required to complete the interference condition of the Stroop Test. The reason behind this selective scoring was to keep the measures as simple as possible while having an accurate indication of frontal function. Several studies reported previously point to the

effectiveness of these two scores among other that are possible to obtain with both the WCST and the Strop Test in assessing frontal function (e.g., Glisky, 1995; Karakaş, 2004).

Table 6

Scores of the Neuropsychological Tests of Frontal Function

		WCST	Stroop Test
20-39 (Young)	n	12	12
	Mean	4.75	20.08
	SD	1.82	4.42
40-59 (Middle Aged)	n	16	16
	Mean	4.31	23.81
	SD	1.78	6.57
60+ (Old)	n	28	28
	Mean	2.71	36.96
	SD	1.63	19.81

Age group was found to affect test scores both for the WCST ($F(2,53) = 7.84$, $p<.01$, $\eta^2 = .23$) and for the Stroop Test ($F(2,53) = 7.27$, $p<.01$, $\eta^2 = .22$). Also in both tests, the scores of the older group (age 60 and over) were significantly lower than those of the two younger groups. Also, the correlations among age, WCST scores, and scores of the Stroop Test were all significant at the $p<.01$ level and are presented in Table 6.

Table 7

Correlations Among Measures of Frontal Function and Age

	Age	WCST	Stroop Test
Age	1.00	-.47	.52
WCST		1.00	-.46
Stroop Test			1.00

Autobiographical Memory Distribution as a Function of Source Monitoring and Frontal Function

Before presenting the results concerning the main hypothesis, which predicted that poorer performance in the source monitoring task would be accompanied by lower scores in neuropsychological tests assessing frontal function and by an accentuated bump in the autobiographical recall curve, correlations among the variables in question are presented in Table 8. Also, since age of the participant was known to affect all the variables in question, a second set of correlations, with the age of the participant partialed out, is presented in Table 9. Since the autobiographical memory distribution of the two groups (middle-aged and old) in the present study showed the bump, unless otherwise noted, data from only these two groups are used while computing correlations as well as in the following analyses.

In order to identify the contributions of age, frontal function, and source monitoring to the bump, a hierarchical regression analysis was performed with the percentage of memories coming from the bump period as the dependent and age, measures of frontal function and measures of source monitoring as the independent variables. The contributions of the predictor variables are summarized in Table 10. Age and frontal function were found to predict the percentage of memories coming from the bump period. However, no significant contribution of source monitoring performance was found.

Table 8

Correlations Among Age, Source Monitoring, and Frontal Function

	Age	% of Memories from the Bump Period	Recall	Internal-External Source Monitoring	Temporal Source Monitoring	WCST	Stroop Test
Age	1.00	-0.30*	-0.16	0.09	-0.33*	-0.41*	0.50*
% of Memories from the Bump Period		1.00	0.22	-0.002	0.16	0.41*	-0.31*
Recall			1.00	0.38*	0.47*	0.18	-0.25
Internal-External Source Monitoring				1.00	0.66*	0.06	-0.22
Temporal Source Monitoring					1.00	0.22	-0.43*
WCST						1.00	-0.46*
Stroop Test							1.00

* correlation is significant at .05 level

Table 9

Partial Correlations Among Source Monitoring and Frontal Function Variables

	% of Memories from the Bump Period	Recall	Internal-External Source Monitoring	Temporal Source Monitoring	WCST	Stroop Test
% of Memories from the Bump Period	1.00	0.19	0.03	0.07	0.33*	-0.19
Recall		1.00	0.40*	0.44*	0.12	-0.20
Internal-External Source Monitoring			1.00	0.73*	0.11	-0.31*
Temporal Source Monitoring				1.00	0.10	-0.33*
WCST					1.00	-0.32*
Stroop Test						1.00

* correlation is significant at .05 level

Table 10

Multiple Regression Table for the Percentage of Memories Coming From the Bump Period

	ΔR^2	F-Change	B	SE	β
1.	.090	4.135*			
Age			-.005	.002	-.299*
2.	.106	2.641*			
Age			-.002	.003	-.118
WCST			.034	.018	.314
Stroop Test			-.001	.002	-.103
3.	.003	.073			
Age			-.001	.003	-.085
WCST			.034	.018	.316
Stroop Test			-.001	.002	-.108
Internal-External Source Monitoring			-.003	.008	-.082
Temporal Source Monitoring			.003	.009	.068

*p<.05

Frontal Function and Source Monitoring

When the total sample was divided into two groups based on their scores on the tests of frontal function, their scores on the source monitoring tasks are found to be affected differentially. While internal-external source monitoring is not found to be affected by the participants' score on the WCST ($t(54) = .88$, $p>.05$) and the Stroop Test ($t(54) = 1.45$, $p>.05$), temporal source monitoring is found to be affected

by the participants' s scores both on the WCST ($t(54) = 2.03$, $p<.05$) and the Stroop Test ($t(54) = 2.12$, $p<.05$). Correct temporal source monitoring was significantly higher ($M = 13.70$, $SD = 4.51$) for participants who scored above the median in the WCST than participants who scored below the median ($M = 11.17$, $SD = 4.83$). Similarly, the participants who scored above the median in the Stroop Test performed significantly higher in the temporal source monitoring task ($M = 13.71$, $SD = 4.05$) than participants who scored below the median ($M = 11.07$, $SD = 5.19$).

When the same analyses were performed with participants over 60, a slightly different pattern emerged. While there was no difference between participants who scored above or below the median in the WCST in terms of their scores in the internal-external ($t(26) = .04$, $p>.05$) or temporal ($t(26) = .02$, $p>.05$) source monitoring scores, participants who scored above the median in the Stroop Test had significantly higher correct responses both in the internal-external source monitoring task ($t(26) = 2.11$, $p<.05$; $M = 16.92$, $SD = 3.75$ vs. $M = 13.27$, $SD = 5.19$) and in the temporal source monitoring task (($t(26) = 2.39$, $p<.05$; $M = 13.08$, $SD = 5.12$ vs. $M = 8.80$, $SD = 4.36$).

Frontal Function and Distribution of Autobiographical Memories

To ensure the homogeneity of the sample in terms of age and the distribution of autobiographical memories, only participants over the age of 60 were included in these analyses. The participants were divided into two groups using a median split based on their frontal function as assessed by the WCST and the Stroop Test. In order to be sensitive to the differences that may result from the intrinsic qualities of the two tests, the scores of both tests are treated individually rather than computing a composite score.

To have a direct and individual measure of the bump, each participant was assigned a score based on the number of the memories they reported. Specifically, each participant had a percentage score for the memories coming from the 10-to-30 period. For the percentage of memories coming from 10-to-30 period performance in the WCST was found to affect the percentage of memories coming from the 10-to30 period ($t(26) = 2.14$, $p<.05$). Participants who scored higher in the WCST reported significantly higher number of memories from the bump period ($M = 42$, $SD = 16$) compared to the participants who scored lower ($M = 29$, $SD = 16$). However, there were no difference between the two groups who scored higher ($M = 38$, $SD = 18$) and lower ($M = 32$, $SD = 16$) in the Stroop Test in terms of the percentage of memories coming from 10-to-30 period ($t(26) = 1.08$, $p>.05$).

The above mentioned differences between the high and low scoring participants in the tests of frontal function in terms of the percentage of memories coming from the bump period are also apparent in Figure 5 and Figure 6.

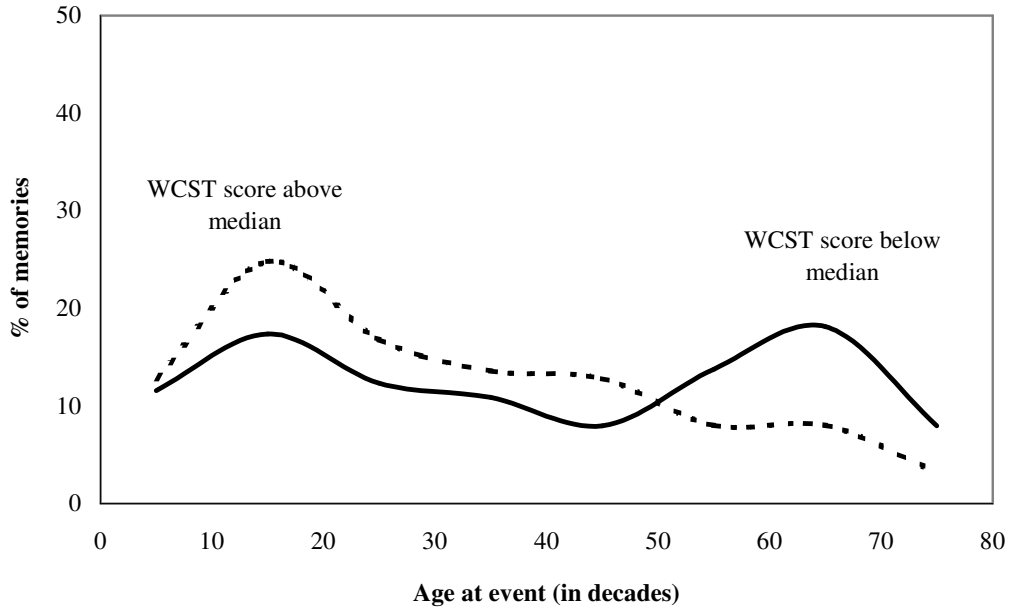

Figure 5. Distribution of autobiographical memories as a function of WCST scores

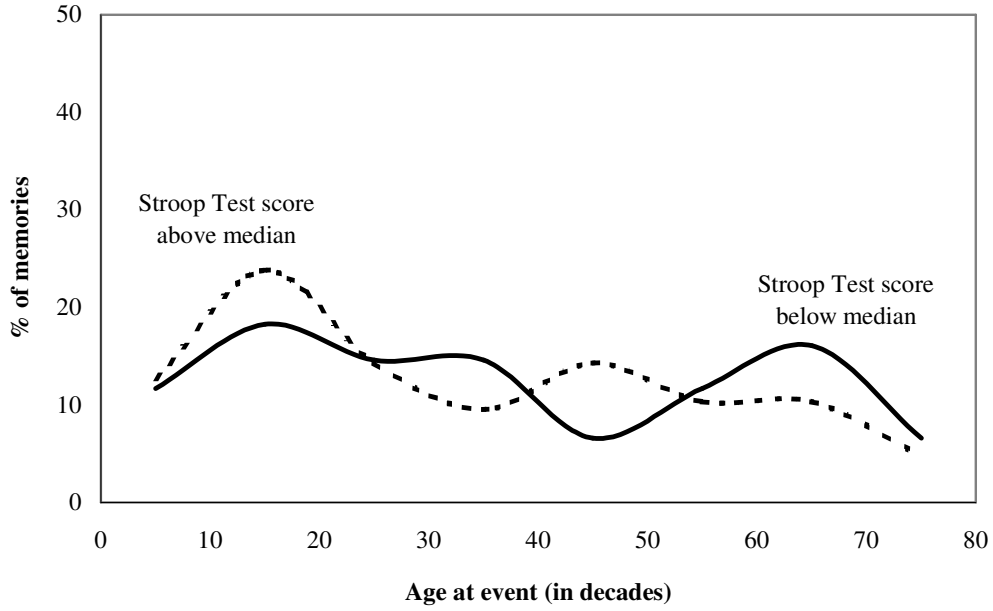

Figure 6. Distribution of autobiographical memories as a function of Stroop Test scores

Source Monitoring and Distribution of Autobiographical Memories

Similar to the analyses performed in the previous section, only participants over the age of 60 were included in the analyses reported below. The participants were divided into two groups using a median split based on their source monitoring performance. Again, similar to the procedure followed in the previous section, the participants' performance in internal-external source monitoring and temporal source monitoring were analyzed separately.

For the percentage of memories coming from 10-to-30 period no difference was found ($t(26) = .11$, $p>.05$) between the participants who scored high ($M = 35$, $SD = 17$) on the internal-external source monitoring task and those who scored lower ($M = 35$, $SD = 18$). Similarly, there were no difference between the two groups who scored higher ($M = 40$, $SD = 15$) and lower ($M = 32$, $SD = 18$) in the temporal source monitoring task in terms of the percentage of memories coming from 10-to-30 period ($t(26) = 1.08$, $p>.05$). The distribution of autobiographical

memories as a function of source monitoring performance is presented in Figure 7 and Figure 8.

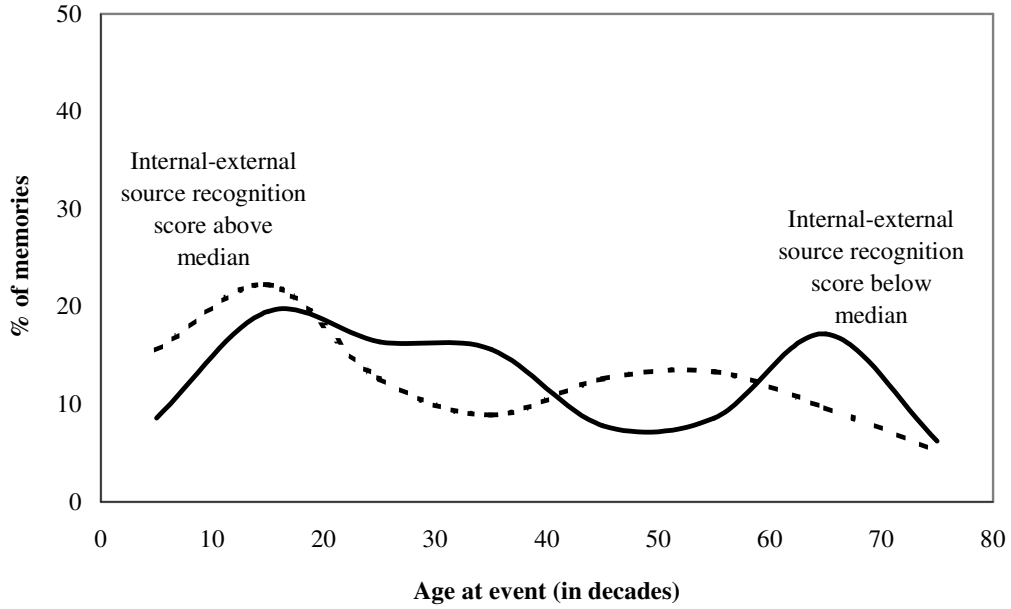

Figure 7. Distribution of autobiographical memories as a function of internal-external source monitoring performance

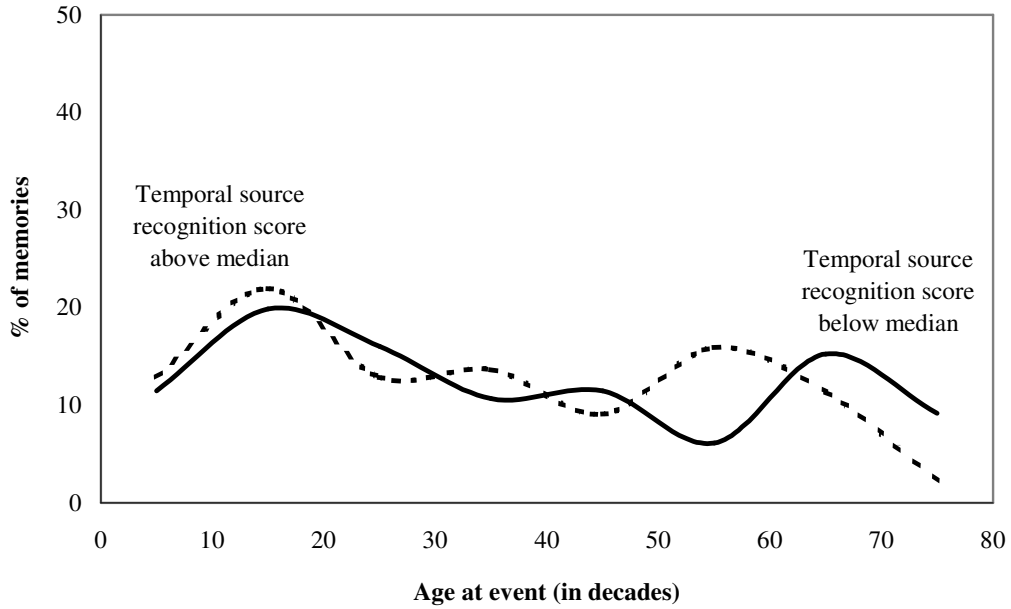

Figure 8. Distribution of autobiographical memories as a function of temporal source monitoring performance

Discussion

The aim of the present study was to identify possible similarities between autobiographical recall and relatively short-term episodic recall as indicated by the life-span distribution of autobiographical memories, source monitoring performance, and frontal function. While the individual components of the present study are found to be consistent with the literature in differing degrees, the expected interrelations among them could not be observed clearly. In the following sections, the findings on the distribution of autobiographical memories, source monitoring, and frontal function will be discussed both individually and in relation to one another.

Distribution of Autobiographical Memories

The data on autobiographical memories were analyzed both in terms of cue-words used to elicit memories and in terms of the general pattern of the life-span distribution of these memories. Exploratory analyses on the cue-words and the age of the participants at the time of the event that the cue-word triggered a memory for singled out two cue-words among others. With the exception of those in the young (between the ages of 20 to 39) group, the participants reported their earliest memories for the word “uçurtma” (kite) and their most recent memories for the word “anahtar” (key). Although the cue-words used were not all identical, the pattern emerged with regard to cue-words was similar to the one observed in a previous study of autobiographical memory conducted with a Turkish sample (Aydın, 2004). In both studies, the word “anahtar” (key) was found to elicit the most recent memories. Also, the other word used in both studies, “sandık” (chest), was found to elicit memories from a similar age range in both studies.

The distribution of autobiographical memories replicated the previous findings concerning the bump. It was found out that both for the middle aged and old

participants the distribution of autobiographical memories showed a bump. As well as the present study constitutes just another addition to the large body of research pointing to a common finding, it can also be seen as extending it to a wider age range since middle aged adults were not consistently reported to show the bump (Rubin et al., 1998).

While the bump was more pronounced in the period between the ages of 10-to-20 for old participants, the middle aged participants' memories were mostly coming from the 20-to-30 period. Similar to the study reported by Jansari and Parkin (1996), the retention component of the autobiographical memory distribution was not observed in the present study due to the restriction brought to reporting the events that have been experienced within last one year. Although they had set their cutoff point to the past $2^1/_2$ years, the 1-year cutoff used in the present study is found to equally suppress the retention component. In contrast, their finding regarding the earlier period covered by the bump when it was obtained with such a modification was not replicated in the present study.

The aim of the present study was not to test the accounts of the bump. As mentioned previously, the main hypothesis was based on the assumption that repetitive remembering of the events that occurred during the bump period was the main factor in its occurrence. Since the account that emphasized this repetitive remembering component the most was the cognitive account (Rubin et al., 1998), support for the main hypothesis could also be seen as indirect support for the cognitive account. Although the typical autobiographical memory distribution was replicated in the present study, evidence on the proposed mechanism that would lead to the bump was not conclusive. Hence, the findings of the present study did not provide evidence for any of the accounts explaining the bump.

The ratings on how much the participants thought about the events that they reported were analyzed both with the aim to inspect age differences and to compare the memories coming from the bump period with the memories coming from other periods of life. When the three age groups were compared with one another, it was found that old participants reported that they thought about the memories more than the middle aged and the young participants did during their lifetime. However, when asked about how much they thought about the reported memories within last year, the ratings of the participants in the old group were higher than from those in the young group only. Extrapolating from experimental studies on the recall of previous episodes of recollection (Arnold & Lindsay, 2002; 2004), it was assumed that lower ratings of having thought about their memories would indicate the forgetting of previous remembering episodes due to impaired source monitoring in old age. Indeed, older participants provided lower ratings but the present data is inconclusive regarding the possible effects of source monitoring performance in providing these ratings.

For a more direct test of the hypothesis, the ratings were also analyzed for each age group separately by contrasting the memories coming from the bump period with the memories coming from other periods. Only middle aged participants reported having thought about the memories coming from the bump period significantly less than the memories coming from other periods, and only when asked about last year. Overall, the ratings that the participants provided for memories coming from the bump period as opposed to those that do not, did not provide evidence in favor of the dissimilarity of the memories coming from these two periods. Indeed, it was previously reported that ratings of rehearsal were similar for

the 10-to-29 bump period and for the following 20-year (30-to-49) period (Rubin & Schulkind, 1997).

It must also be noted that, the general pattern of the ratings provided by the participants suggests that the corresponding findings should be interpreted with caution. The participants might have treated the first rating, that is the rating of how much they thought about the event in total, as a benchmark for the following rating of how much they thought about the event within last year. Except for a few cases, the second rating was always lower than the first one regardless of the age of the participant.

The general lack of difference within the young group, both for the ages of their reported memories and for the ratings that they provided for these memories can be interpreted as a result of the limited pool of memories and time interval to chose their memories from compared to their older counterparts. Middle aged and old participants, on the other hand, showed significant differences in terms of the distribution of their autobiographical memories and but not in terms of the ratings on how much they thought about the memories that they reported.

Aside from replicating previous findings concerning the distribution of autobiographical memories, the present study also attempted to link them to more controlled, experimental studies of memory. By redefining the tasks required by autobiographical recall, a micro-level replica of a typical cue-word paradigm was thought to be a source monitoring task, of which the findings are discussed in the following section.

Source Monitoring

Source monitoring performance of the participants was assessed by asking them to discriminate among seen and imagined pictures and by asking them to

temporally locate this experience of seeing or imagining a given picture. There were three groups of items that the participants were required to make source attributions; the items presented once, the items presented once and imagined once, and the items presented once and imagined three times. In line with the hypotheses stated previously, both item type and age of the participants were found to affect recall and source monitoring performance.

Regarding the recall performance of the participants, item type was found to have an effect in each age group. However, this effect was more pronounced for the middle aged and old participants that it was for the young participants. For young participants only items seen once and imagined three times were recalled better than other items, that is items seen once and items seen once and imagined once. For middle aged and old participants, however, all three item types were recalled at different rates, with items seen once having lowest and items seen once and imagined three times having the highest recall rate. Thus, middle aged and old participants benefit from repetition more than young participants do. Indeed, the recall rate of items seen once, but not the recall rate of other item types, was higher in the young group compared to two other groups.

When they are presented with an item once, young participants outperform their older counterparts in recall. Increasing the number of presentations, even by imagining, improves the performance of older groups while the performance of the young group does not improve at a similar rate.

Regarding the internal-external source monitoring performance, contrary to the hypotheses, no age difference was found. However, in each age group, items seen once and imagined once presented more difficulty to the participants in discriminating whether they were seen, imagined or both. Items seen once and items

seen once and imagined three times, in contrast, are discriminated significantly better as seen or seen or imagined, depending on the condition, than items seen once and imagined once.

It was hypothesized that, especially for older participants, the more an item was imagined following the first presentation the more likely the participants would misattribute the source as being external, not both external and internal. This hypothesis was formulated as the experimental equivalent of the possible mechanism leading to the bump observed in the distribution of autobiographical memories. Source misattributions were proposed to be more likely when the diagnosticity of available source information is reduced (Johnson & Mitchell, 2002). Imagining an item several times following the actual presentation of that item was thought as a factor that would make the experience of imagining similar to the experience of perceiving the item. In fact, older adults have been previously reported to make less accurate source attributions in similar situations. When they both perceived and imagined items with similar features, they were reported to have more difficulty in identifying an imagined object as imagined rather than perceived (Henkel et al., 1998). Contrary to the expectations, imagining an item only once after the presentation, as opposed to not imagining it at all or imagining it three times, closed the gap between the experience of perceiving the item and the experience of imagining it, therefore led to more errors in source attributions in all three age groups. Although similar findings were reported in a study carried out with a younger sample (Henkel et al., 2000), the lack of age differences in the present study requires further investigation.

Regarding temporal source monitoring, correct source attribution was highest for items seen once and imagined three times in all age groups. Once again, no age

difference was observed for any item type. Age was found to affect temporal source monitoring only in total. Participants in the young group are found to perform better in the temporal source monitoring task when all item types are considered together.

Combining the two younger groups, that is the participants between the ages of 20 and 60, and contrasting them with the older group, that is the participants over the age of 60, resulted in minor changes. While recall and internal-external source monitoring showed the same pattern, age is found to affect temporal source monitoring only for items seen once and imagined once and items seen once and imagined three times.

Considering recall and source monitoring performance together, the most plausible explanation for the current results is that the source monitoring task might have presented more difficulty to all participants than expected. That might have suppressed age differences, yet not eliminated differences due to item type. Another possible explanation is the one recently articulated by Salthouse (2004). In his reanalysis of studies on age-related differences in cognitive functioning, he pointed out that, contrary to the common assumption, age-related decline in cognitive functions might be beginning in early adulthood, before age 50. Speculatively, if that happened to be the case in the present study, the hypothesized age differences might have been overshadowed by the early start of age-related decline.

Frontal Function

As reported consistently in the literature (e.g., Glisky, 2001; Reuter-Lorenz, 2000) older participants are found to have an impaired performance on the tests of frontal function compared to younger participants. In addition, performance on both tests of frontal function, the WCST and the Stroop Test were found to correlate significantly both with each other and with the age of the participants. However,

there is also implication that frontal function, as assessed by several neuropsychological tests, cannot be decomposed into individual constructs that those tests intend to measure. Rather, it should be treated as a general factor contributing to cognitive functioning (Salthouse, Atkinson, & Berish, 2003). Since this finding casts shadow on the individual use and reliability of neuropsychological tests of frontal function, it will be discussed further in the following section in relation to the dissociation between the WCST and the Stroop Test observed in the present study.

Frontal Function and Source Monitoring as Predictors of the Distribution of Autobiographical Memories

The main hypothesis put forward in the present study received only partial support from the results presented so far. The findings concerning the three main variables investigated in the present study, distribution of autobiographical memories, source monitoring performance, and frontal function, were compatible with the rest of the literature, when examined separately. However, they were not found to converge in providing evidence for a mechanism involving the impairment of frontal function and source monitoring as the precursor of the bump.

Two sets of correlations were obtained to test the main hypothesis. In addition to the simple correlations obtained to test the main hypothesis, a second set of correlations was obtained by partialing out the age of the participants reasoning that all the variables in the present study were consistently shown to have age-related changes. Simple correlations showed that age correlated with both measures of frontal function but only with one measure of source monitoring, that of temporal source monitoring. It was also found to correlate with the percentage of the memories coming from the bump period. Interestingly, this correlation was negative. Although, the bump was observed for the participants included in this analysis,

percentage of memories coming from the bump period as an individual measure of the bump implied that old age did not necessarily lead to the bump in the life span distribution of autobiographical memories. In contrast, older participants were found to report less memories from the bump period. The percentage of memories coming from the bump period was also found to correlate with both measures of frontal function. However, these correlations were also difficult to interpret. Contrary to the hypothesis, percentage of memories coming from the bump period was higher for the participants who performed well on both tests.

It was previously reported that age, although a good indicator of cognitive performance, might not be the sole contributor in group differences. Rather, grouping older participants based on their performance in different cognitive domains was proposed to predict their performance in other domains more accurately. Frontal function was one of these domains in which age-related changes were observed uniformly yet in differing degrees (Glisky, et al., 1995).

To assess the relationship between the tests of frontal function and source monitoring performance, the participants were compared using a median split. Also, rather than obtaining a composite score of frontal function, the analyses were performed for two tests of frontal function separately. Since the tests might be tapping different aspects of frontal function, it was reasoned that any difference due to using different tests as grouping variable might also indicate the differential involvement of these aspects in source monitoring. Indeed, such a difference was observed for older participants.

Source monitoring performance is found to be differentially affected by frontal function. While internal-external source monitoring remained unaffected by frontal function, accurate temporal source monitoring was found to be higher for the

participants who scored above median in the tests of frontal function. In order to eliminate possible effects of age other than those on frontal function, the same analyses were performed once again only with participants over the age of 60. This time, both types of source monitoring decisions were found to be affected by frontal function but only as assessed by the Stroop Test. Older participants' performance on the WCST was not found to affect the percentage of correct source monitoring decisions.

Similar to the study reported by Glisky et al. (1995), older participants' source monitoring performance was found to depend on their frontal function. Unlike the above mentioned study, in which participants' frontal function was assessed by a battery of neuropsychological tests and a composite score derived from them, frontal function was assessed by two separate tests in the present study. The resulting difference between the two tests can be interpreted in several ways.

Regarding the distribution of autobiographical memories, the effects of frontal function and source monitoring performance on the percentage of memories coming from the bump period were investigated. Although the bump was apparent for middle aged participants in the present study and was also previously observed to appear even as early as the age of 40 (Rubin et al., 1998), a more conservative approach was adopted to test the main hypothesis and the relevant analyses were performed only with the participants over 60.

Frontal function was not found to have the hypothesized effects on the bump. Once again, the participants were divided in two groups based on their scores on the tests of frontal function using a median split. When the participants scoring above the median and those scoring below were compared in terms of the percentage of memories coming from the bump period, it was found that the participants scoring

above the median in the WCST reported more memories from the bump period compared the participants scoring below the median. However, there appeared no difference when the participants were grouped on the basis of their scores in the Stroop Test.

It was hypothesized that impaired frontal function would lead to an accentuated bump. It appeared that was not the case. However, the differential effects of the WCST and the Stroop Test on source monitoring performance and the distribution of autobiographical memories have several implications and also provide ground for future research in the area. The WCST was found to affect the number of memories coming from the bump period than the Stroop Test does. On the other hand, the Stroop Test was found to affect source monitoring performance than the WCST does. The dissociation between the two measures of frontal function might be indicative of several propositions, which does not exclude one another. As pointed out previously (Salthouse et al., 2003), the current findings may reflect the different processes as well as the different brain areas tapped by these tests as opposed to providing a general assessment of frontal function. Related to that, they might also be reflecting of the involvement of networks of brain areas rather than any individual region in such tasks (Grady, 2001). Consequently, the WCST can be thought as having similar cognitive demands with autobiographical recall while the Stroop Test can be thought as having similar demands with the source monitoring task. Indeed, this proposition is compatible with previous studies pointing out to the pitfalls of extrapolating from laboratory studies of memory to more naturalistic ways of remembering such as autobiographical recall (Gilboa, 2004). On the other hand, it nullifies the main hypothesis of the present study even without the need of testing

since it was based on the idea of redefining the task of dating autobiographical memories as a temporal source monitoring task.

Source monitoring, either, was not found to have an effect on the percentage of memories coming from the bump period. When the participants were grouped on the basis of their correct source attributions, it appeared that the participants with higher source monitoring scores reported as many memories from the bump period as the participants with lower scores. Also, task type, that is, internal-external source monitoring or temporal source monitoring, was not found the affect this pattern.

In their attempt to identify the origin of the observed differences in the source monitoring performance of older adults Glisky et al. (2003), showed that the source monitoring performance was impaired in older adults due to the parallel impairment in encoding, not in retrieval. This also, provided a ground to suggest that older adults would not be as efficient as their younger counterparts in encoding the remembering episodes of a previously experienced event. However, this proposition did not found support as assessed by the source monitoring task in the present study as it is indicated by the lack of age differences in correct internal-external source monitoring. Also, the ratings about thinking about the reported event in the autobiographical recall section of the study did not provide conclusive evidence. Only middle aged participants reported that they thought about the memories coming from the bump period less than they thought about the memories from other periods within last year.

As noted previously, the present study aimed at identifying the role of frontal function as a component of autobiographical recall. However, the findings were not conclusive regarding the contribution of frontal function to the distribution of autobiographical memories. Adopting a wider perspective and starting by the

involvement of frontal lobes in memory processes in general might prove useful while looking for possible explanations for the current findings.

Based on the cumulative body of research on the role frontal lobes in memory processes, hemispheric encoding/retrieval asymmetry (HERA) in the prefrontal cortex (Tulving, Kapur, Craik, Moscovitch, & Houle, 1994) was proposed to account for the consistently observed pattern in imaging studies. In short, it states that the differential involvement of the left prefrontal cortex in the retrieval of information from semantic memory, and in the simultaneous encoding information into episodic memory in contrast to the involvement of the right prefrontal cortex in episodic memory retrieval. Together with the previously reported finding of the involvement of the left frontal lobe in reflective activity and source monitoring decisions (Nolde et al., 1998), this might be an indication of people's reliance in semantic memory in making source attributions. Indeed, especially in older adults, source attributions are found to be based on general knowledge, stereotypes (Mather et al., 1999) or schematic knowledge (Mather, & Johnson, 2003).

Levine (2004), differentiating between episodic and semantic autobiographical memory, pointed that autobiographical recollection could be depending on a distributed system rather than being a specifically localized activity. Taken together with the current attempts to identify the differential contribution of frontal areas to specific frontal functions as well as the networks contributing to memory processes as identified by imaging studies, failing to observe the hypothesized findings in the present study can be interpreted as a result of the simplistic view of the processes in question.

Inherent in the main hypothesis, source monitoring performance was thought to depend, mostly if not solely, on the proper functioning of the frontal areas, and the

distribution of autobiographical memories were expected to represent this pattern. However, the results imply that both source monitoring and autobiographical recall might not be the behavioral outcome of a localized activity as hypothesized. Rather, a network approach would be helpful in covering more ground and in interpreting the data at hand.

With an optimistic view, the present study can be treated as a preliminary work of an attempt to unify seemingly parting branches of memory literature. Related to that, the major shortcoming of the present study was that it was too ambitious in terms of theoretical consequences relative to the possibilities at hand to carry out an equally ambitious and comprehensive research. To overcome these practical constraints, further research can contribute to this line of research by providing more detailed findings or by offering methodological improvements concerning the individual parts of the present study.

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Appendices

APPENDIX A
INTERVIEW FORM

Onay Formu

Bu çalışma Boğaziçi Üniversitesi Psikoloji Bölümü yüksek lisans tezi için yapılan bir araştırmanın parçasıdır. Araştırma kişilerin geçmiş deneyimlerini nasıl hatırladığıyla ilgilidir. Bu araştırma kapsamında sizinle yapacağımız çalışmada sizden geçmişteki bazı anılarınızı hatırlamanızı isteyeceğim, size bu anılarla ilgili bazı sorular soracağım ve sonrasında yine hafızayla ve diğer bilişsel becerilerle ilgili birkaç standart test yapacağım. Kişisel bilgileriniz ve test sonuçlarınız isimsiz olarak saklanacak ve sadece bu araştırmadan sorumlu kişiler tarafından görülebilecektir. Bu çalışmaya katılımınız kendi isteğinize bağlıdır. Bu çalışmayla ilgili bir sorunuz olduğunda aşağıdaki telefon numarası ve e-mail adresi aracılığıyla bilgi alabilirsiniz.

Bu formdaki bilgileri okudum, çalışmanın kapsamını anladım ve gönüllü olarak bu çalışmaya katılmaya karar verdim.

Tarih: / / 2005

Araştırmacı
İsim : İdil Ayça Karaca

Tel. :

e-mail:

İmza :

Katılımcı
İsim : .....

İmza :

Katılımcı no:

Adı Soyadı: .....

Cinsiyeti: Kadın Erkek

Doğum Tarihi: .....

Test Tarihi: .....

Yaş: .....

Eğitim:

Lise

Yüksekokul

Üniversite ve üstü

Notlar:

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1. KİRAZ

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Tarih:..... Yaş:.....

Bu olayı yaşadıktan sonra üzerinde ne kadar düşündünüz?

- hayatınız boyunca

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

- son bir sene içinde

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

2. GERDANLIK

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Tarih:..... Yaş:.....

Bu olayı yaşadıktan sonra üzerinde ne kadar düşündünüz?

- hayatınız boyunca

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

- son bir sene içinde

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

3. TOPRAK

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Tarih:..... Yaş:.....

Bu olayı yaşadıktan sonra üzerinde ne kadar düşündünüz?

- hayatınız boyunca

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

- son bir sene içinde

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

4. REÇEL

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Tarih:..... Yaş:.....

Bu olayı yaşadıktan sonra üzerinde ne kadar düşündünüz?

- hayatınız boyunca

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

- son bir sene içinde

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

5. UÇURTMA

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Tarih:..... Yaş:.....

Bu olayı yaşadıktan sonra üzerinde ne kadar düşündünüz?

- hayatınız boyunca

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

- son bir sene içinde

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

6. MAKAS

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Tarih:..... Yaş:.....

Bu olayı yaşadıktan sonra üzerinde ne kadar düşündünüz?

- hayatınız boyunca

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

- son bir sene içinde

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

7. GÜL

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Tarih:..... Yaş:.....

Bu olayı yaşadıktan sonra üzerinde ne kadar düşündünüz?

- hayatınız boyunca

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

- son bir sene içinde

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

8. ANAHTAR

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Tarih:..... Yaş:.....

Bu olayı yaşadıktan sonra üzerinde ne kadar düşündünüz?

- hayatınız boyunca

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

- son bir sene içinde

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

9. SANDIK

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Tarih:..... Yaş:.....

Bu olayı yaşadıktan sonra üzerinde ne kadar düşündünüz?

- hayatınız boyunca

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

- son bir sene içinde

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

10. ÖRDEK

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Tarih:..... Yaş:.....

Bu olayı yaşadıktan sonra üzerinde ne kadar düşündünüz?

- hayatınız boyunca

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

- son bir sene içinde

1	2	3	4	5
hiç	nadiren	zaman zaman	sıkça	çok sık

Katılımcı no:

Hatırlama:

1. …….
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23. …….
24. …….

A: ...../8

B: ...../8

C: ...../8

Toplam: ...../24

Diğer: .....

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D	**1a. SİLAH**	**H** □			
	a) sadece gördüm	**b)** sadece hayal ettim	**c)** hem gördüm hem hayal ettim	**d)** ne gördüm ne hayal ettim
	1b. SİLAH ile hangi bölümde karşılaştınız?			
	a) sadece 1. bölümde	**b)** sadece 2. bölümde	**c)** hem 1. hem 2. bölümde	**d)** ne 1. ne 2. bölümde
D	**2a. YATAK**	**H** □		
	a) sadece gördüm	**b)** sadece hayal ettim	**c)** hem gördüm hem hayal ettim	**d)** ne gördüm ne hayal ettim
	2b. YATAK ile hangi bölümde karşılaştınız?			
	a) sadece 1. bölümde	**b)** sadece 2. bölümde	**c)** hem 1. hem 2. bölümde	**d)** ne 1. ne 2. bölümde
C	**3a. ÇİLEK**	**H** □		
	a) sadece gördüm	**b)** sadece hayal ettim	**c)** hem gördüm hem hayal ettim	**d)** ne gördüm ne hayal ettim
	3b. ÇİLEK ile hangi bölümde karşılaştınız?			
	a) sadece 1. bölümde	**b)** sadece 2. bölümde	**c)** hem 1. hem 2. bölümde	**d)** ne 1. ne 2. bölümde
E	**4a. AYAKKABI**	**H** □		
	a) sadece gördüm	**b)** sadece hayal ettim	**c)** hem gördüm hem hayal ettim	**d)** ne gördüm ne hayal ettim
	4b. AYAKKABI ile hangi bölümde karşılaştınız?			
	a) sadece 1. bölümde	**b)** sadece 2. bölümde	**c)** hem 1. hem 2. bölümde	**d)** ne 1. ne 2. bölümde
A	**5a. KUTU**	**H** □		
	a) sadece gördüm	**b)** sadece hayal ettim	**c)** hem gördüm hem hayal ettim	**d)** ne gördüm ne hayal ettim
	5b. KUTU ile hangi bölümde karşılaştınız?			
	a) sadece 1. bölümde	**b)** sadece 2. bölümde	**c)** hem 1. hem 2. bölümde	**d)** ne 1. ne 2. bölümde
E	**6a. TOKA**	**H** □		
	a) sadece gördüm	**b)** sadece hayal ettim	**c)** hem gördüm hem hayal ettim	**d)** ne gördüm ne hayal ettim
	6b. TOKA ile hangi bölümde karşılaştınız?			
	a) sadece 1. bölümde	**b)** sadece 2. bölümde	**c)** hem 1. hem 2. bölümde	**d)** ne 1. ne 2. bölümde
A	**7a. TARAK**	**H** □		
	a) sadece gördüm	**b)** sadece hayal ettim	**c)** hem gördüm hem hayal ettim	**d)** ne gördüm ne hayal ettim
	7b. TARAK ile hangi bölümde karşılaştınız?			
	a) sadece 1. bölümde	**b)** sadece 2. bölümde	**c)** hem 1. hem 2. bölümde	**d)** ne 1. ne 2. bölümde

B **8a. KEMER** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

8b. KEMER ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **9a. GÖZLÜK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

9b. GÖZLÜK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

D **10a. RADYO** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

10b. RADYO ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **11a. YÜZÜK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

11b. YÜZÜK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

B **12a. CÜZDAN** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

12b. CÜZDAN ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

A **13a. ODUN** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

13b. ODUN ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

D **14a. ÇOCUK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

14b. ÇOCUK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

A **15a. KÜVET** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

15b. KÜVET ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **16a. BARDAK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

16b. BARDAK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

C **17a. AYNA** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

17b. AYNA ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **18a. SAAT** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

18b. SAAT ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

D **19a. HALI** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

19b. HALI ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

C **20a. FARE** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

20b. FARE ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

B **21a. BALIK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

21b. BALIK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **22a. TELEFON** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

22b. TELEFON ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **23a. KİTAP** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

23b. KİTAP ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

B **24a. KALE** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

24b. KALE ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **25a. MASA** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

25b. MASA ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

B **26a. YASTIK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

26b. YASTIK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

B **27a. KOVA** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

27b. KOVA ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

C **28a. TABAK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

28b. TABAK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **29a. SANDALYE** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

29b. SANDALYE ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

D **30a. KÜREK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

30b. KÜREK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

A **31a. BEBEK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

31b. BEBEK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **32a. KALEM** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

32b. KALEM ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **33a. KAZAK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

33b. KAZAK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

C **34a. KEMİK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

34b. KEMİK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

B **35a. SİNCAP** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

35b. SİNCAP ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **36a. KÜPE** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

36b. KÜPE ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

A **37a. HORTUM** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

37b. HORTUM ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **38a. DOLAP** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

38b. DOLAP ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

B **39a. GÖMLEK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

39b. GÖMLEK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

D **40a. PEYNİR** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

40b. PEYNİR ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

A **41a. FIRIN** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

41b. FIRIN ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

C **42a. ROBOT** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

42b. ROBOT ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

A **43a. YAPRAK** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

43b. YAPRAK ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

C **44a. ÇİVİ** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

44b. ÇİVİ ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **45a. ÇORAP** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

45b. ÇORAP ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

C **46a. ZİNCİR** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

46b. ZİNCİR ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

D **47a. RESİM** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

47b. RESİM ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

E **48a. PENCERE** **H** □

a) sadece gördüm | **b)** sadece hayal ettim | **c)** hem gördüm hem hayal ettim | **d)** ne gördüm ne hayal ettim

48b. PENCERE ile hangi bölümde karşılaştınız?

a) sadece 1. bölümde | **b)** sadece 2. bölümde | **c)** hem 1. hem 2. bölümde | **d)** ne 1. ne 2. bölümde

APPENDIX B
INSTRUCTIONS

I.

Bu çalışma kişilerin geçmiş deneyimlerini nasıl hatırladığıyla ilgilidir. Şimdi size bazı kelimeler söyleyeceğim. Bu kelimelerin aklınıza getirdiği ilk anıyı kısaca anlatmanızı istiyorum. Bu kelimelerin size çağrıştırdığı olayları ya da deneyimlerinizi hatırlamaya çalışın.

Bunlar mutlaka sizin de içinde bulunduğunuz ya da tanık olduğunuz olaylar olmalıdır. Uzunluğu saniyeler, dakikalar veya saatler sürmüş olabilir ama mesela, gün boyunca süren uzun bir olayı anlatmanızı istemiyorum. Daha çok o uzun olayın kısa bir parçasını ya da başınızdan geçen kısa süreli, ayrıntılı ve özel bir anıyı anlatmanızı rica ediyorum.

Aynı şekilde, eğer belirli bir zamana ya da olaya karşılık gelmiyorsa alışkanlıklarınıza ya da sürekli yaşadığınız olaylara dair anılarınız da bu çalışmanın kapsamı dışındadır. Örneğin her hafta sonu yaptığınız bir şey, eğer o hafta sonları arasından belirli bir tanesini hatırlamıyorsanız vereceğiniz cevaplar arasında olmamalıdır.

Anlatacağınız olaylar çok ilginç ya da önemli olmak zorunda değildir. Başınızdan geçen herhangi bir olayı anlatabilirsiniz.

Bu, eskiden yaşadığınız ya da yeni bir olay olabilir. Ancak son bir sene içinde yaşadığınız bir olay olmamasına dikkat edin.

Ben ilk kelimeyi söyledikten sonra hemen cevap vermeyin, kendinize düşünmek için süre tanıyın. Aklınıza ilk gelen olayı söyleyin.

Aklınıza birden çok anı geliyorsa lütfen en uygun bulduğunuzu (en ayrıntılı olanı) seçiniz.
Yaşadığınız bu olayı bana bir kaç cümleyle özetleyebilir misiniz? Eğer isterseniz isim ve yerleri değiştirebilirsiniz ancak olayın kendisine mümkün olduğunca sadık kalmaya çalışın.

...

Şimdi size anlattığınız her olayla ilgili bir kaç soru soracağım.

...

II.

Bu çalışma **iki** bölümden oluşacak. **Birinci** bölümde de **ikinci** bölümde de size arka arkaya bazı kelime ve resimler göstereceğim. Bunlar günlük hayatta karşılaşabileceğiniz şeylere ait resimler olacak. Her resmin üzerinde o resmin adı da yazılı olacak. Her **iki** bölümde de ben her resmi gösterdikçe üzerinde yazılı olan kelimeyi yüksek sesle okumanızı ve ben bir sonraki resme geçene kadar da yazının altındaki resme dikkatlice bakmanızı istiyorum. Her kelimeyi ve resmi mümkün olduğunca aklınızda tutmaya çalışın çünkü daha sonra sizden bu kelime ve resimleri hatırlamanızı isteyeceğim. Bazı kartlarda ise sadece kelime göreceksiniz. Sadece kelimenin yazılı olduğu ancak resmin olmadığı kartlarla karşılaştığınızda yapmanız gereken kartta yazılı kelimeye ait nesneyi aklınızda canlandırmaktır. Ancak bu nesneleri aklınızda canlandırırken nesnenin kendisini değil, yine bu kartlarda olduğu gibi bir çizimini düşünmelisiniz. Şimdi bir kaç örnek yapalım [DAİRE – YILDIZ – KARE - ÜÇGEN]. Örneğin burda gökyüzündeki yıldızı değil de bu kağıdın üzerinde olabilecek bir yıldız resmini aklınıza getirmelisiniz. Hazırsanız **birinci** bölüme başlayabiliriz.
(5sn. vs. 3sn.)

...

Şimdi **ikinci** bölüme geçebiliriz. Bu bölümde de **birinci** bölümde olduğu gibi elimdeki kartların üzerindeki kelimeleri okumanızı, eğer resim varsa o resmi incelemenizi yoksa yazan kelimeye ait nesneyi hayal etmenizi istiyorum. Hazırsanız **ikinci** bölüme başlayabiliriz.
(5sn. vs. 3sn.)

...

İlk bölümün başında kelime ve resimleri hatırlamanız gerekeceğini söylemiştim. Şimdi ilk bölümdeki kelimelerin hatırlayabildiğiniz kadarını bana söylemenizi istiyorum.

...

Şimdi size elimdeki kağıttan bazı kelimeler okuyacağım. Bunların bazıları bu çalışma içinde şimdiye kadar gördüğünüz bazıları ise henüz karşılaşmadığınız kelimeler olacak. Okuduğum her kelime için bir karar vermenizi istiyorum. Eğer o kelimeyi daha önce gördünüz ancak hayal etmediyseniz “sadece gördüm”, daha önce hayal ettiniz ancak görmediyseniz “sadece hayal ettim”, hem gördünüz hem de hayal ettiyseniz “hem gördüm hem hayal ettim”, ne gördünüz ne de hayal ettiyseniz “ne gördüm ne hayal ettim” cevabını vermenizi istiyorum. Biraz önceki hatırlama testinden farkli olarak bu sefer çalışmanın her iki bölümünü de göz önünde bulundurarak cevap verin. Yani sorduğum bir kelimeyi hem birinci hem ikinci bölümde karşılaştığınız kelimelerin tamamını düşünerek değerlendirin. Hazırsanız başlayabiliriz.

...

Şimdi yine biraz önce size okuduğum kelimelerle ilgili bir karar vermenizi istiyorum. Bu sefer okuduğum kelimeyle hangi bölümde karşılaştığınızı hatırlamanız gerekecek. Eğer okuduğum kelime ile sadece birinci bölümde karşılaştıysanız

“sadece 1. bölümde”, sadece ikinci bölümde karşılaştıysanız “sadece 2. bölümde”, her iki bölümde de karşılaştıysanız “hem 1. hem 2. bölümde”, her iki bölümde de karşılaşmadıysanız “iki bölümde de karşılaşmadım” cevabını vermenizi istiyorum. Bu soruları cevaplarken söylediğim kelimeyi görmüş ya da hayal etmiş olmanız arasında bir fark yoktur. Görmüş de hayal etmiş de olsanız dikkat etmeniz gereken bunu birinci bölümde mi ikinci bölümde mi yapmış olduğunuzdur. Hazırsanız başlayabiliriz.

...

III.

WCST

Bu biraz değişik bir test, çünkü testi nasıl yapacağınız konusunda size pek fazla bilgi vermemem gerekiyor. Bu testte, destedeki her bir kartı bu dört anahtar karttan biriyle eşlemeniz gerekiyor. Elinize aldığınız kartın yüzünü çevirin ve kartı, onunla eşleştiğini düşündüğünüz anahtar kartın aşağısına yerletirin. Kartları neye göre eşleyeceğinizi size söyleyemem ama yaptığınız eşlemenin doğru mu yanlış mı olduğunuher seferinde size söyleyeceğim. Eğer yanlış yapmışsanız, kartı olduğu yerde bırakın ve bir sonraki kartı desteden alarak doğru eşlemeye çalışın. Her seferinde destenin en üstündeki kartı alın, destenin sırasını bozmayın. Her anahtar kartla eşlediğiniz kartları o kartın aşağısına üst üste yığarak yerleştirin. Önce bu (1.) destedeki kartları yerleştirin, daha sonra bu (2.) desteyle devam edin. Bu testte zaman sınırlaması olmadığından acele etmeniz gerekmemektedir. Sorunuz yoksa başlayabilirsiniz.

STROOP

Şimdi size bazı kartlar göstereceğim. Ben "başlayın" dedikten hemen sonra sizden bu kartlarda yazılı olan kelimeleri okumanızı veya kartlardaki renkleri söylemenizi isteyeceğim. Kelimeleri mümkün olduğu kadar hızlı okumaya, renk isimlerini mümkün olduğu kadar hızlı söylemeye çalışın. Kelimeleri okurken veya renkleri söylerken hata yaptığınızı farkederseniz hemen doğrusunu söyleyin.

I. Siyah Basılmış Renk İsmi Okuma

Bu karttaki kelimeleri mümkün olduğu kadar hızlı okumanızı istiyorum. Şimdi parmağımı izleyin. Okumaya buradan başlayın ve soldan sağa doğru gidin. Hata yaptığınızı fark ederseniz düzeltin. Başlayın.

II. Renkli Basılmış Renk İsmi Okuma

Şimdi de bu karttaki renk isimlerini mümkün olduğu kadar hızlı okumanızı istiyorum. Kelimenin basımında kullanılan renk önemli değil, buna dikkat etmeniz gerekmiyor. Sizden istenen kelimeleri okumanız. Deminki gibi sıranın başından başlayın ve soldan sağa doğru gidin. Hata yaparsanız düzeltin. Başlayın.

III. Şekil Rengi Söyleme

Şimdi bu karttaki dairelerin renklerini mümkün olduğu kadar çabuk söylemenizi istiyorum. Sıranın başından başlayın ve soldan sağa doğru gidin. Hatalarınız olursa hemen düzeltin. Başlayın.

IV. Renk İsmi Olmayan Kelime Rengi Söyleme

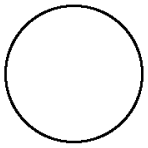
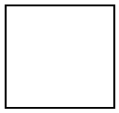
Şimdi bu kartaki kelimelerin renklerini mümkün olduğu kadar çabuk söylemenizi istiyorum. Sıranın başından başlayın ve soldan sağa doğru gidin. Hata yaparsanız düzeltin. Başlayın.

V. Renk İsmi Olan Kelime Rengi Söyleme

Şimdi de kelimelerin hangi renkle yazılmış olduğunu mümkün olduğu kadar çabuk söylemenizi istiyorum. Kelimeyi okumayın, rengini söyleyin. Yine sıranın başından başlayın ve soldan sağa doğru gidin. Fark ettiğiniz hataları derhal düzeltin. Başlayın.

APPENDIX C

WORDS AND PICTURES USED IN THE SOURCE MONITORING TASK

DAİRE 	YILDIZ	KARE 
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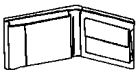
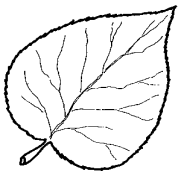
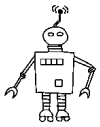
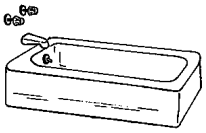
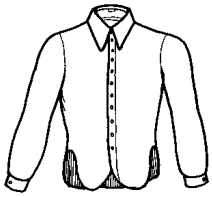
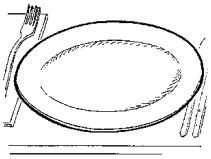
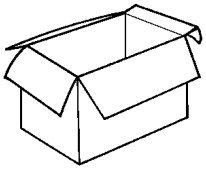
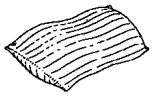
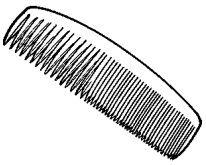
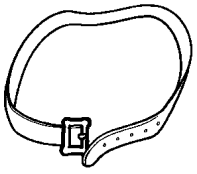
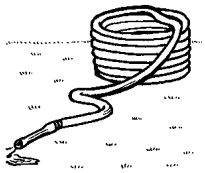
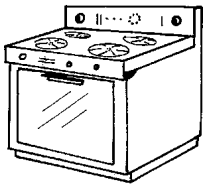
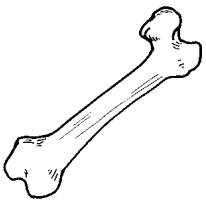
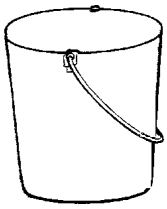
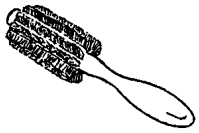
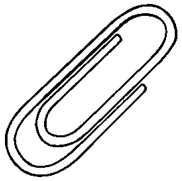
ODUN 	ÇİVİ 	CÜZDAN 

SİNCAP 	YAPRAK 	ROBOT 
AYNA 	KÜVET 	GÖMLEK 
FARE 	TABAK 	KALE 

KUTU 	ÇİLEK 	YASTIK 
TARAK 	ZİNCİR 	BALIK 
KEMER 	HORTUM 	FIRIN 

KEMİK 	KOVA 	BEBEK 
	II	FIRÇA 
YASTIK	CÜZDAN	ATAÇ 

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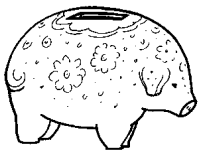
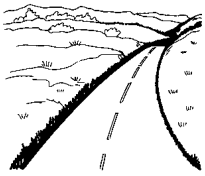
KUPA 	PEYNİR	HALI

KUMBARA 	YOL 	AYNA
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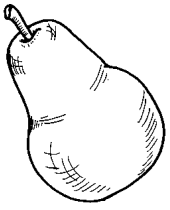
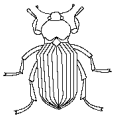
ARMUT 	BALIK	BÖCEK 

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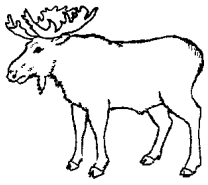
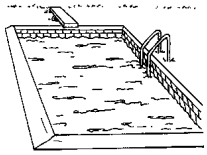
GEYİK 	KRAVAT 	AYNA
ZİNCİR	HAVUZ 	GÜL 

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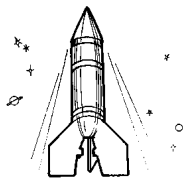
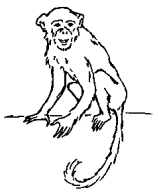
VAZO 	SİNCAP	ROKET 
FARE	ÇİVİ	MAYMUN 

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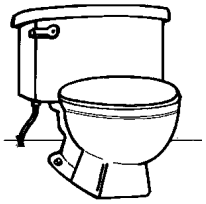
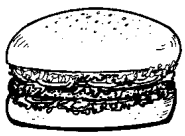
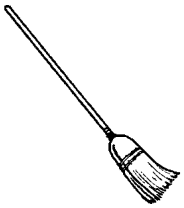
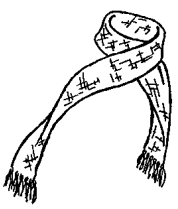
TUVALET 	YAĞMUR 	FARE
KEMİK	PAPAĞAN 	KEMER

HAMBURGER 	TABAK	ÇATI 
ZİNCİR	YENGEÇ 	SÜPÜRGE 
GÖMLEK	ÇİLEK	ATKI 

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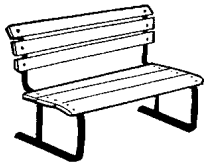
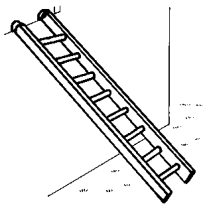
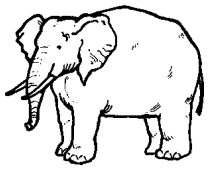
ÇOCUK	BANK 	KASET 
KALE	KÜREK	MERDİVEN 

FİL 	FARE	SÜTUN 
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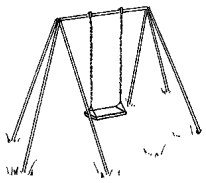
ROBOT	SALINCAK 	TABAK
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