BEHAVIORAL METHODS EMPLOYED TO INVESTIGATE THE STRUCTURE OF AUTOBIOGRAPHICAL MEMORIES

OTOBİYOGRAFİK BELLEĞİN YAPISINI ARAŞTIRMAK İÇİN KULLANILAN DAVRANIŞSAL YÖNTEMLER

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Abstract

Memory research conducted in laboratories require controlled experiments in order to eliminate the confounding factors that can affect memory retrieval. However autobiographical memories require the retrieval of distant memories which are most of the time not verifiable. Due to the differences related to autobiographical memory these controlled experiments cannot be used and different methods are required. Cue word technique, diary studies, recording event by using devices, Autobiographical Memory Interview and Autobiographical Interview are some of the behaioral methods employed for autobiographical memory research. These methods have both some advantages and some disadvantages which should be considered before they are used, according to the needs of research. The findings from the studies employing these methods indicated that autobiographical memory has a hierarchical organization, it consists of a semantic component and an episodic component, and some of the cues are ineffective for the retrieval of autobiographical memories. Most of these methods can also be employed in research investigating the impaired components of autobiographical memory for patients with memory disorders like Alzheimer's disease. In this review the behavioral methods employed to investigate the structure of Autobiographical memories will be explored. First the differences of autobiographical memory from memory investigated in laboratory and the need for different methods in autobiographical memory research will be mentioned. Then behavioral methods to investigate the structure of autobiographical memory, how they are used and the findings obtained from these studies seperately and in common will be discussed.

Öz

Laboratuvar ortamında gerçekleştirilen bellek araştırmalarında karıştırıcı etkenlerin etkisini ortadan kaldırabilmek amacıyla yöntemsel olarak kontrollü deneyler kullanılmaktadır. Ancak otobiyografik bellek araştırmaları çoğu zaman doğrulanması mümkün olmayan uzak dönem belleğin geri getirilmesini gerektirdiği için farklı yöntemlere ihtiyaç duyulmaktadır. İpucu kelime tekniği, günlük ve günlük benzeri kayıt cihazları kullanılması, otobiyografik bellek görüşmesi ve otobiyografik görüşme gibi yöntemler otobiyografik bellek araştırmalarında kullanılan davranışsal yöntemlerdir. Bu farklı yöntemlerin birbirleriyle kıyaslandığı zaman farklı avantajları ve dezavantajları bulunmaktadır. Bu yöntemleri kullanan araştırmalar sonucunda otobiyografik bellek yapsının hiyerarşik olduğu, semantik ve epizodik bileşenlerden oluştuğu, geri çağırma aşamasında kullanılan ipuçlarının bazılarının hiç kullanılamadığı gibi sonuçlara ulaşılmıştır. Alzheimer Hastalığı gibi hafıza problemleri olan hasta gruplarında da kullanılabilen bu yöntemler yaşın ilerlemesi ile birlikte otobiyografik hafızada meydana gelen değişikliklerin ve bozulmaların hangi bileşenlerde olduğunu incelememizi sağlamıştır. Bu incelemede otobiyografik belleğin yapısını araştırmak için kullanılan davranışsal yöntemler ve bu araştırmaların sonuçları ele alınacaktır. Öncelikle laboratuvar ortamında gerçekleştirilen bellek araştırmalarında kullanılan yöntemlerden, otobiyografik belleği farklı kılan yönlerinden ve neden farklı yöntemlere ihtiyaç duyulduğundan bahsedilecektir. Sonrasında bu farklı yöntemlerden sadece davranışsal olanlara ve otobiyografik bellek yapısını incelemek amacıyla önerilenlere değinilecektir. Bu yöntemlerin neleri içerdiğine, nasıl kullanıldığına ve bu yöntemleri kullanan bazı araştırmaların sonuçlarına değinildikten sonra genel olarak farklı yöntemleri kullanan bütün araştırmaların otobiyografik bellek yapısı hakkında ortaya koydukları ortak sonuçlar değerlendirilecektir.

Introduction

The aim of memory research is to find methods for assessing past experiences and interpreting their results to understand the structure, nature and characteristics of memory. When autobiographical memory is considered, which can be defined as remembering past experiences specific for the rememberer's own life (Cabeza & St Jacques, 2007; Rubin, 2005), methods used for assessments conducted in laboratory cannot be employed for investigating it. The aim of memory experiments is to control the conditions of encoding and retrieval to minimize potential sources of confound in the interpretation of test performance. These controlled memory experiments conducted in laboratories to investigate episodic memory, mostly involve a study phase in which the participants are provided with a study list that should be encoded, and a test phase in which they are asked to retrieve the items from the study list by using either a recall or a recognition test. Tulving (1972, 1985) introduced the episodic memory and semantic memory concepts, which are memory for personally experienced events and memory for facts or general world knowledge, respectively. According to Tulving (1985, 2002) episodic memory is about remembering what happened with the specific time and place information and it requires a rememberer with autonoetic consciousness about the mental time travel they make during remembering.

Contrary to episodic memory investigated in laboratory, autobiographical memories are self selected and for most of them determining what in reality happened is not verifiable. Autobiographical memory involves remote memory retrieval, complex constructive processes and is influenced by factors like emotion, vividness, personal relevance. Due to these distinctions autobiographical memory cannot be investigated by employing the controlled methods used in laboratories (Brewer, 1996; Cabeza & St Jacques, 2007; Robinson, 1986; Rubin, 2005).

Related to this complexity of assessment of autobiographical memories, different methods have been introduced in order to investigate different aspects of it. These methods can be behavioral or neuropsychological methods to uncover the structure and nature of autobiographical memory. In this review, only the behavioral methods employed to investigate the structure of autobiographical memory will be explored in detail, but due to the incredible number of studies related to it, it is not possible to do it exhaustively. Methods investigating individual differences in autobiographical memory are not in the scope of this article.

BEHAVIORAL METHODS TO INVESTIGATE THE STRUCTURE OF AUTOBIOGRAPHICAL MEMORY

The cue-word technique

The cue-word technique was introduced by Galton (1879) and Crovitz and Schiffman (1974) further developed it. When using the cue word technique, the participants are presented with a high frequency, concrete and imaginable word and they are asked to report a past experience, the date of that memory and rate the experiences related to the recalled event. This technique is mostly used to investigate the distribution of reported memories and the strategies people use to search and retrieve autobiographical memories. It is commonly used for sampling autobiographical memories since it has the advantage of allowing participants to freely choose a memory across their life time. But this may become a disadvantage when the participants are people with memory disorders, because when allowed to freely remember from the past, they may retrieve memories from a special time period which may be related to their cognitive declines (Berntsen, Kirk, & Kopelman, 2022).

The cue-word technique has also been used to investigate autobiographical memory retrieval of patients with mood disorders like depression. In the Autobiographical Memory Test (Williams & Broadbent, 1986) participants are provided with cue-words with different emotional valences and they are required to recall a memory related to it. Findings from research using AMT indicate that people who are depressed recall events with much less detail compared to controls (Williams & Broadbent, 1986; Williams et al., 2007).

Recording events by using diaries

One of the problems regarding autobiographical memory research methods that do not take records of the events over time is the inability to check the accuracy of the events recalled. In order to allow the assessment of accuracy, diary studies have been introduced (Linton, 1975; Sotgiu, 2021; Talarico, 2022; Wagenaar, 1986; White,1982, 1989, 2002, 2020).

Linton (1975) conducted her diary studies in order to find out about the accuracy of dating over time. For five years, every day she recorded two to three events and rated some features of them. Following various retention intervals spanning from one month to three years, she attempted to remember the date of the recorded event using the event's description. The findings from her study indicated

that as the time between the recording and recall of the event increased, recall became more difficult and forgetting increased.

For six years, Wagenaar (1986) recorded his memories with a set of cues including "who," "what," "where," and "when," with the importance and emotional involvement of each event. During the recall process, to retrieve the memories he had recorded, he relied on these cues. During the process of recording his memories, Wagenaar (1986) included also a crucial detail along with a corresponding question and answer. He selected this critical detail so that if the event was successfully retrieved from memory using all the provided cues, the critical detail would also be recalled with certainty. So this critical detail he used can be considered as the cue related to the gist or the meaning of the memory tested in a cued recall test.

White (1982) recorded one event for each day over a year and then tested himself after a year and two years, then after 5 years (White, 1989) and then for the third time after 20 years (White, 2002) and finally for the last time after 40 years (White, 2020). The recorded events were rated on several dimensions like the vividness, emotional involvement, frequency and perceptual qualities. Findings from White's (1982, 1989, 2002, 2020) recalled memories and their properties are similar to Linton's (1975) and Wagenaar's (1986) findings. As time passes, it becomes more difficult to recall the events. The time and date of the events are not recalled easily, correctly or in order of sequence. Another finding from White (1989, 2002, 2020) was that as events were rated as infrequent, the better they were recalled.

Despite certain drawbacks associated with diary studies, such as their reliance on a single participant and participants' event selection, the findings from diary studies have uncovered some key aspects of autobiographical memory. They have provided insights into the influence of cues on memory recall, the significance of encoded event characteristics like emotional involvement and importance as well as the role of the passage of time in the forgetting of autobiographical memories.

Recording events by using electronic devices such as video cameras

Recording events by using video cameras and filming is another method employed to investigate autobiographical memory. Compared to diary studies, this method has certain advantages such as allowing recording from multiple participants and not being limited to self-selected memories (Chow & Rissman, 2017; Sreekumar, Nielson, Smith, Dennis, & Sederberg, 2018).

As an example of recording by using video cameras, the daily activities of a healthy woman were filmed for two days (Mendelsohn, Furman, Navon, & Dudai, 2009). This video was initially intended to be used as a documentary in the researcher's laboratory. Therefore, at the time the participant was being filmed, she was uninformed of the memory tests. Four months after and two years and four months after the filming, she was given a memory questionnaire while fMRI scans were taken. The memory questionnaire consisted of a verbal questionnaire and a pictorial questionnaire. The verbal one was composed of "yes" or "no" questions that were followed by confidence judgments about the recognition of the recorded events. Some questions had accurate details while others had inaccurate ones. In the pictorial test, for each image a cued-recall test followed by a recognition test was administered. During the cued recall test, she was presented with an image and a particular detail, and she had to recall it. In the subsequent recognition phase, the image and a two forced choice question were presented, which she had to answer and give a confidence rating. Both the accuracy and confidence ratings were analyzed.

The results of Mendelsohn et. al's (2009) study revealed important findings related to the accuracy and belief in the autobiographical memories and the contribution of the episodic and semantic components in these judgements. For instance, as time passed the acceptance of false details increased. In other words compared to recent memories the acceptance of "yes" judgments increased for remote memories, which came along with an increase in confidence judgments. The analysis related to imaging revealed that there was no difference for the accuracy of recent versus remote memories, but there was a difference for the confidence ratings. For recent memories confidence judgments were associated with the memory instead of its accuracy. And the confidence judgments for remote memories were found to be based on personal semantic knowledge.

Autobiographical memory interview (AMI)

To investigate the episodic and semantic components of autobiographical memory in detail, methods other than the cue-word and diary studies were required, which were mostly based on interview techniques. Autobiographical Memory Interview (AMI) was introduced as a tool for evaluating retrograde amnesia, which is the inability to remember distant memories (Kopelman, Wilson, & Baddeley, 1989). AMI and extended versions of AMI are still used for investigating autobiographical memory decline in patients with Alzheimer Disease (Barnabe,

Whitehead, Pilon, Arsenault-Lapierre, & Chertkow, 2012; Berntsen et al., 2022; Irish, 2023). The AMI comprises an interview that aims to evaluate the recall of autobiographical events, the episodic component of autobiographical memory, and personal facts from a participant's past, in other words the personal semantic memory. Participants are asked to recall events and facts from different stages of their lives, including childhood, early adulthood, and recent past.

In the episodic component of autobiographical memory interview, participants are presented with names of events, like "in kindergarten,"; "the birth of first child", and "an event that happened where they are staying" from childhood, adulthood and recent past, respectively. The patients are required to provide specific memories associated with these cues rather than a general memory. If participants cannot produce specific memories, additional cues are provided.

Participants are also required to provide personal facts like the name of their first teacher, the date of their wedding and the name of the place they are residing in for childhood, early adulthood and recent past, respectively. Researchers record participants' responses, and two independent experimenters assess these reports. Autobiographical events are scored based on the richness of details, as well as the ability to recollect the time and place of the recalled event. Prior to scoring, the accuracy of memories is verified by consulting the patients' relatives, examining medical records or patient's memory reports.

Criticisms related to the usage of AMI suggest that using separate tests in order to evaluate the semantic memory component of autobiographical memory may unnaturally seperate the two components of autobiographic memory (Murphy, Troyer, Levine, & Moscovitch, 2008). Employing seperate tests may overlook the interaction of these two components in real life autobiographical memory retrieval.

Autobiographical interview

The Autobiographical Interview (Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002) was introduced to avoid employing two assessments to examine the dissociation between the episodic and semantic memory components of autobiographical memory. The Autobiographical Interview requires the participants to recollect a personal past experience from five distinct life periods, which are from their early childhood, adolescence, early adulthood, adulthood and the last year. Participants are instructed to select any event they were personally involved, they recollected, events having specific time and place information from one of these five

periods, but not to select events they did not personally experience. Then they are asked to provide all the detail related to the recollected event in five minutes for each event, until the time is up.

The five events are recorded and assessed based on the degree of internal and external detail they contain. Internal details are related to episodic memory and are subcategorized as the event itself, the location, the timing, and detailed information. Other details are external details, which are semantic information, repeated and unrelated details.

In their study concerning patients with amnesic mild cognitive impairment, a condition resembling anterograde amnesia, employing the Autobiographical Interview Murphy et al. (2008) demonstrated the separation of the episodic and semantic components of autobiographical memory.

Life Event Inventory (LEI)

Life Event Inventories (LEIs) are another method that is used in autobiographical memory research (Bernstein, Whittlesea, & Loftus, 2002; Garry, Manning, Loftus, & Sherman, 1996; Heaps & Nash, 1999), but it has certain distinctions which makes it different from the methods that have been discussed up to now. In the already mentioned methods, participants are required to recall the events when a cue is given, so they are similar to the recall or cued recall tests used in laboratory studies. In studies using LEIs, the participants are required to make a judgement about the occurrence of the events in the inventory by using for instance an 8-point Likert scale. So this method can be considered as an analogue of recognition tests used in laboratories, but the accuracy of the memory judgement cannot be checked for autobiographical memories, while it can be checked in the episodic memory studies conducted in laboratory. Utilizing LEIs in research allows for the exploration of how manipulations carried out during the retrieval phase of recognition have an impact on autobiographical memories. Examples of retrieval phase manipulations include imagination inflation studies (Garry et al., 1996; Heaps & Nash, 1999; Sharman, Garry, & Beuke, 2004) and the revelation effect studies on autobiographical memory (Bernstein, Rudd, Erdfelder, Godfrey, & Loftus, 2009; Bernstein et al., 2002). In imagination inflation studies, participants are instructed to imagine the event described by half of the LEI items have occurred in their childhood before assessing their confidence for LEI items. In revelation effect studies, participants are asked to solve a revelation task for half of LEI items, before evaluating their confidence in the occurrence of the events in their childhood

described by them. For both of these manipulations, confidence in the occurrence of the event in the past increases for the LEI items that involve the manipulation. Therefore research interested in the alterability of autobiographical memories mostly use LEIs as a method.

Results

The results of the studies using the different methods discussed in the preceding section, point to some general findings related to the structure of autobiographical memories. The first one is the hierarchical organization of autobiographical memories (Linton, 1975; Wagenaar, 1986; Conway, 2005). Specific levels of representations, which include specific details about the event like the date, location and perceptual information are integrated in the general levels of representation.

For instance if the word "toy" is given as a cue-word, "I used to play with my favorite toy when I was in primary school." is a representation at a general level, whereas "When I was in 3rd grade, during the semester break, while I was playing with my favorite toy, suddenly it broke and I cried for a long time, until my mother promised to buy me a new one." would correspond to an event at the specific level.

According to the Self Memory System concept, at the most specific level of the hierarchical organization of autobiographical memory lies episodic memories (Conway & Playdell-Pierce, 2000; Conway, 2005). The general level of representation is the autobiographical knowledge base which corresponds to personal semantic memory. If episodic memories are not integrated to the autobiographical knowledge base (Conway, 2005, 2009), they will be forgotten (Conway, 2009). Consequently, SMS framework proposes autobiographical memory to consist of an episodic component and a semantic component.

The findings from studies using the different methods like using AMI (Kopelman, Wilson & Baddeley, 1989), Autobiographical Interview (Levine et al., 2002; Murphy et al., 2008), using recording and filming (Mendelsohn et al., 2009) and other studies (Cabeza & Jacques, 2007) also supported this proposal. By using Autobiographical Interview as the method, results from Murphy et al.'s (2008) study showed that compared to control group, patients with amnesic mild cognitive impairment recalled less internal details and more external details, which is a measure episodic memory and semantic memory, respectively. Since the memory deficit of these patients is impaired episodic memory with an intact semantic

memory, these findings from patient groups also support the idea that autobiographical memories are composed of both an episodic and a semantic component.

The second common finding from the studies using the cue-word, diary and recording, and interview methods is related to forgetting and incorrect remembering. As the retrieval delay increased, more autobiographical memories were forgotten or retrieved inaccurately (Linton, 1975; Wagenaar, 1986; Crovitz & Schiffman, 1974; Conway, 2005, 2009; Mendelsohn et al., 2009), the number of recalled memories decreased (Crovitz & Schiffman, 1974) and recall became more difficult (Linton, 1975). However, even though they are remembered inaccurately, autobiographical memories are characterized by a high confidence in the occurrence of the event and a strong belief that it is remembered accurately (Brewer, 1986; Mendelsohn et al., 2009). The findings related to the effects of retrieval delay and the dissociation between recent and distant memories suggest that for distant memories, memory recollection depends on semantic autobiographical knowledge instead of vivid episodic recollection (Mendelsohn et al., 2009).

The third finding is related to the cues. Some cues are more informative for autobiographical retrieval compared to others. Results of diary studies (Linton, 1975; Wagenaar, 1986) and studies using recording via a digital camera (Burt, 1992, 2008) indicated that the date of an event cannot meet the criterion to be a search cue for memory retrieval. In the memory representation of an event the date information is probably absent, which indicates that autobiographical memories are not chronologically indexed. When the cues were compared to each other the “when” cue was the least effective for autobiographical memory retrieval, it could become an informative cue if it was used with other cues (Wagenaar, 1986).

The results of studies using the cue-word technique were the foundations of the distribution of autobiographical memories over the lifespan. Autobiographical memory distribution over the lifespan for participants older than 50 years old has a typical distribution (Rubin & Schulkind, 1997). The first observed phenomena is the childhood amnesia which is almost no reported memories before the age of three (Bauer, 2015; Rubin & Schulkind, 1997). The second observed phenomena is the reminiscence bump, which is the tendency of the participants to recall most of the memories from the period they were 10 – 30 years old (Munawar, Kuhn, & Haque, 2018; Rubin & Schulkind, 1997).

The fourth finding is there is a certain pattern of search for autobiographical memory retrieval when a cue word is provided. The participants' verbal protocols indicated that related to the cue, first they find a context, which corresponds to the semantic component of autobiographical memory. While searching within that context, they come up with a new cue related to the first one and further generates a new one. When the memory is finally found, it is from the episodic memory component of autobiographical memory (Conway, 2005; Conway & Pleydell-Pearce, 2000). This search strategy used for autobiographical memory retrieval was first introduced as the search-elaborate-evaluate model (Norman & Bobrow, 1979) and it was modified to generative retrieval model (Conway, 2005). The search mechanism proposed by Cabeza and Jacques (2007) is also in accordance with the generative retrieval model. When a cue word is provided an effortful search under the guidance of semantic personal and world knowledge is required for the retrieval of an autobiographical memory.

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Summary

Memory research conducted in laboratories require clearly defined and controlled experiments and methods to be able to come up with clear explainations about the structure and characteristics of memory. Episodic memory is defined as the memory for personally experienced events and semantic memory is defined as the memory for world knowledge and facts (Tulving, 1972). Autobiographical memory on the other hand is also defined as the memory for personally experienced events, but what makes it different from episodic memory is that autobiographical memory also requires the retrieval of distant memories from the past spanning the lifetime and it also involves a semantic component. In other words autobiographical memory is proposed to consist of two components. One of them is the semantic component, which corresponds to personal semantic knowledge and the other one is the episodic component. According to the Self Memory System (Conway & Playdell-Pierce, 2000; Conway, 2005), episodic memories are at the most specific level of the autobiographical memory organization and they are attached to the autobiographical knowlegde base, which the personal semantic memory component of autobiographical memory. Methods employed to investigate autobiographical memories helped autobiographical memory researchers to reach these conclusions related to the structure of autobiographical memory like the composition of the episodic and semantic components of it.

Due to the diffferences of autobiographical memory compared to laboratory memory, resaerch on autobiographical memory requires different methods. In order to investigate remote memory retrieval from different periods of lifetime, methods like the cue-word technique, recording event by using diary studies, recording events by using electronic devices such as video cameras, interview methods such as autobiographical memory interview (AMI) and Autobiographical Interview and Life event inventories have been

introduced. The cue-word technique requires participants to remember a memory when a cue word is provided. Research using the cue-word technique found out that the distribution of autobiographical memories has a typical pattern involving childhood amnesia and reminiscence bump. The cue word technique has also been employed in order to investigate the retrieval differences of patients with mood disorders. The diary studies and other recording methods has the advantage of keeping a record of the events so that the accuracy of the memory can be checked. However the first diary studies of Linton (1975), Wagenaar (1986) and White (1982) has the disadvantage of using only a single participant with the participant freely choosing the events. This problem has been overcome by using recording techniques like video recording and using participants other than the researcher himself or herself to record their memories. The findings from diary studies and studies using video or audio recording indicated that retrieval of memories become more difficult as the time between recording and retrival increases and also the recalled memories become inaccurate. The date of the memory is not an effective search cue for the memory and autobiographical memory is not chronologically ordered. As more cues are provided an autobiographical memory that has not been retrieved by only one cue may be retrieved. The critical cue related to the event which corresponds to the gist of the memory will surely be retrieved if the event is remembered when the other cues are provided.

Autobiographical memory interview and Autobiographical Interview are interview techniques that investigate the details related to the remembered event. They are mostly employed to evaluate the memory of patients with Alzheimer's disease, retrograde amnesia or anterograde amnesia. The findings from studies using the interview techniques also indicate that autobiographical memory is composed of an episodic component and a semantic component and with memory decline due to aging, autobiographical memory retrieval starts to depend on the semantic component of autobiographical memory. In other words, the retrieved memories has less episodic details and instead of reliving, these memories are mostly based on personal facts and personal semantic knowledge.

Studies using Life event inventories are mostly used to investigate the change in the confidence and belief in the occurence of an event by using certain manipulations during retrieval. Studies using LEI are mostly interested in the changeability of autobiographical memories. Studies using video recording and diary studies also showed that for remote memories even though the memories have more inaccuracy, the confidence in the occurence of the event did not decrease.

The results of the research using behavioral methods like the cue-word technique, diary and other recording studies and interview techniques point to some general findings related to the structure of autobiographical memory. Autobiographical memory is not chronologically ordered, but has a hierarchical nature with the episodic memories attached to the personal semantic component. As the time between the retrieval and recording of the event increases, more forgetting and inaccurate remembering is observed. With aging and in memory disorders like Alzheimer's disease or amnesia, the impaired component of autobiographical memory is mainly the episodic component. So in this article the behavioral methods for autobiographical memory research and findings from research using these methods were reviewed.