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Autobiographical memory in Korsakoff syndrome: a review

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Abstract

Autobiographical memory (AM) (i.e., memory for personal information) is a unique form of memory that goes beyond recalling information such as what, where and when of an event, to include what that event means and why it is important to our life story. This paper therefore reviews the available literature on AM in Korsakoff syndrome (KS). It summarizes the characteristics of AM disorders in KS patients. These disorders are mainly characterized by the difficulties that patients with KS have in retrieving and reliving specific AMs and in retrieving recent and remote memories. Another core characteristic of AM disorders in KS is confabulations. This paper hypothesizes that patients with KS may produce autobiographical confabulations to support their objectives and beliefs or even to answer a social demand or simply to share personal experiences with others. Although the current evidence demonstrates disorders of AM in KS, there is a need for more research about the characteristics of these disorders. This review thus proposes several perspectives for theoretical and clinical research.

Keywords: autobiographical memory; confabulations; Korsakoff syndrome; memory

Introduction

Autobiographical memory (AM), i.e., memory for personal information, is a unique form of memory that goes beyond recalling factual information such as what, where and when of an event to include what that event means and why it is important to our life story. By allowing the construction of our life story, AM provides explanatory frameworks replete with events that contribute to our identity and defines the kind of persons we are. AM is therefore important as it allows not only retrieval of general information about ourselves but, critically, the construction of our life story, as memories of our personal experiences allow us to construct meaning and view ourselves and the world from a unique perspective [1-4]. Difficulties in AM, as observed in patients with amnesia, results in a weakened ability to retrieve general personal information (e.g., a patient's difficulty to remember her/his home address). Critically, it leads to difficulties in retrieving information related to the sense of self (e.g., a patient's difficulty in remembering events that define her/his life story such as first date or wedding day). These difficulties, as observed in patients with Korsakoff syndrome (KS), result in a weakened sense of self and

identity. Critically, one of the core characteristics of the disorders of AM in KS patients is confabulations, i.e., the tendency to produce erroneous memories. However, before discussing this issue, we first describe the functioning of AM (i.e., semantic and episodic autobiographical retrieval, distribution of AM, correspondence/coherence of memories). Then, we describe the difficulties of patients with KS in retrieving and subjectively experiencing episodic AMs. We also shed light on the ability of patients with KS to retrieve memories from different life periods. Finally, the focus is placed on autobiographical confabulations, followed by concluding remarks.

KS is a neurologic syndrome associated with thiamine deficiency, malnutrition and prolonged heavy ingestion of alcohol [5, 6]. At the neurological level, it can be associated with atrophy in the dorsomedial thalamus, the mammillary bodies and in the frontal cortex [7, 8]. At the cognitive level, KS is associated with memory disorders [6, 9-12] as well as with a decline in executive function [13, 14] and social cognition [6, 15-17]. While decline in these cognitive aspects in KS can have a significant impact on a patient's daily life, disorders of AM can heavily impact their sense of self and identity.

Methodology

To implement this review, a strategy for critical evaluation and literature search was developed and followed according to current practices for conducting systematic reviews. Search began by inquiring the literature using MEDLINE (via PubMed) and Google Scholar databases. Search was conducted using a combination of the following search terms and key words: autobiographical memory; confabulations; Korsakoff syndrome; memory. Search was limited to journals published in English and to empirical research with human subjects. Thus, animal studies, letters, editorials, and commentaries were excluded. For each article included in the

review, a manual check of its bibliography was performed to identify potential relevant material. In addition, articles citing the included articles were also manually checked.

Functioning of autobiographical memory

AM can be broken down into episodic and semantic subcomponents, a distinction rooted in the work of Tulving [18] who distinguished between the ability to retrieve general facts that are abstracted from the context in which they are learnt (i.e., semantic memory) and the ability to retrieve specific events situated in time and space (i.e., episodic memory). Semantic retrieval triggers what Tulving coined “noetic consciousness” or the subjective experience involving an abstract sense of time as well as a general awareness of knowing and understanding the world and the self. On the other hand, episodic retrieval triggers what he called “autonoetic consciousness” or the ability to travel back in time to experiencing oneself being present at the time when the remembered event originally took place.

Besides the semantic vs. episodic distinction, AM can be distinguished in terms of its distribution across the lifespan. AM is not distributed equally across our lifespan, as it has been demonstrated that the distribution of AM follows a specific pattern that includes three core components, namely, childhood amnesia, the reminiscence bump, and the recency effect [19, 20]. Childhood amnesia refers to the typical difficulty in retrieving memories of events that were encountered prior to the age of three to four years [21, 22]. This difficulty has been associated with the development of the brain [23] and language during childhood [24], as well as with difficulties that young children experience in creating robust memories [25] and in retaining them over long periods [26]. The reminiscence bump refers to the tendency of middle-aged and older adults to remember relatively more events from adolescence and early adulthood than from

other periods [27]. This tendency has been attributed to several factors. For instance, it has been proposed that adolescence and early adulthood involve first-time experiences (e.g., first dating) that are used later in life as exemplars when we encounter similar experiences [28]. These first-time events refer to self-defining memories, i.e., those highly vivid and emotional memories of events that have had a large impact on the person's identity [29]. Another explanation of the reminiscence bump is that AM may function more efficiently in adolescence and early adulthood, resulting in the efficient storage and creation of memories [21, 30]. Like the considerable amount of memories from the reminiscence bump, people typically retrieve more AMs from the last five to ten years than memories that were encoded previously (i.e., the recency effect) [31]. This effect can be attributed to a progressive loss of retention as the temporal distance between encoding and retrieval increases [32].

The functioning of AM does not only depend on whether the retrieved event describes a general or a specific event or even an old or a recent one, but also on whether the event supports our goals and beliefs. According to Conway [3], autobiographical retrieval depends on two principals, one aiming to represent the past as it was experienced (i.e., correspondence), and the other aiming to reconstruct it in such way as to support a sense of one's life experience (i.e., coherence). In other words, while correspondence operates during retrieval to make memories correspond to the original experienced event, coherence operates during retrieval to make memories consistent with our current beliefs and goals, i.e., those mental models of the identity in relation to the past, present and future. Thus, while correspondence serves to make memories correspondent with reality to support relatively accurate representations of events in order to guide behavior in adaptive ways, coherence serves to make memories consistent with the current goals to provide the self with stability.

To summarize, autobiographical retrieval depends on the specificity of the memory and its subjective experience, its lifetime distribution and its correspondence and coherence. As emphasized below, autobiographical retrieval in patients with KS can be characterized by difficulties in retrieving and reliving specific memories as well as in retrieving recent and remote ones. Critically, their tendency to produce erroneous memories (i.e., confabulations) can be attributed to dysfunction in the correspondence/coherence principles.

Dysfunction of autobiographical memory in KS

[Diminished autobiographical specificity in KS](#)

A core characteristic of autobiographical disorders in KS is the difficulty that patients have in retrieving specific AMs, i.e. in remembering personal events that happened at a particular place and time. This difficulty was documented by Kopelman [9] who invited patients with KS to remember specific autobiographical events in order to investigate whether they tended to produce general rather than specific memories. Similar findings were reported by El Haj and colleagues [12, 33-35] who invited patients with KS to retrieve AMs that were later analyzed regarding their specificity, i.e. whether each memory depicted 1) a general theme, 2) a repeated or an extended event, 3) an event situated in time and/or space, 4) a specific event lasting less than 24 h and situated in time and space, or 5) a specific event situated in time and space enriched with phenomenological details such as feelings, perceptions or emotions. Results demonstrated low autobiographical specificity in patients with KS. Similar findings were reported by Rensen et al. [36] who observed difficulties in retrieving specific AMs in patients with KS. Interestingly, these difficulties were observed on two autobiographical tests assessing several lifetime periods.

The difficulty that patients with KS have in retrieving specific AMs can be compared with that reported by laboratory-based research reporting difficulties in patients with KS in remembering the specific context in which self-unrelated information was previously encountered, such as remembering the location of pictures of objects on a screen [37-39], the location of words presented in the corners of a screen [40], the location of pictures on cards [41], the location in which objects had been placed [42], the position of a spot of light presented on a board [43], to whom information has been told [44], and the duration of events [45-49]. These studies mirror the general impairment of episodic memory in KS [10, 50, 51] as well as the contextual account according to which episodic memory decline in KS is caused by an inability to encode, store or retrieve contextual information [5]. Together, research on AM has demonstrated [9, 12, 33, 34] difficulties in patients with KS in retrieving personal AMs, mirroring a large body of laboratory-based research showing difficulties in patients in remembering the context in which (general) information was previously encoded.

[Diminished autobiographical subjective experience in KS](#)

The diminished ability to retrieve specific AMs in KS patients can be associated with a diminished ability to subjectively experience these memories. The subjective experience of AM was evaluated by El Haj and Nandrino [12] who invited patients with KS to retrieve AMs and to rate their phenomenological characteristics. They were asked to rate:

- Travel in time (“I feel that I am traveling back to the time it happened”)
- Reliving (“I feel as though I am reliving the original event”)
- Remembering (“I can actually remember it rather than just knowing that it happened”)
- Visual imagery (“I can see it in my mind”)

- Auditory imagery (“I can hear it in my mind”)
- Language (“I or other people are talking”)
- Emotion (“I can feel now the emotions I felt then”)
- Realness (“I believe the event in my memory really occurred in the way I remember it”)
- Importance (“this memory is significant for my life”)
- Rehearsal (“since this event happened, I have thought or talked about it”)
- Spatial specificity (“I can recall the place where it occurred”)
- Temporal specificity (“I can recall the time when it occurred”).

While results of the study by El Haj and Nandrino [12] revealed lower mean sense of reliving of AM in patients with KS than in controls, a piecemeal analysis of the phenomenological characteristics revealed that patients with KS attributed greater emotional value and more importance to their memories than the controls did. In other words, while results revealed low mean sense of reliving of AM in patients with KS, the latter strongly experienced affective characteristics such as emotion and importance. These results demonstrate that some AMs, as retrieved by patients with KS, can be laden with emotional value and personal importance.

Building on the above-mentioned study, another study [33] investigated the subjective experience of AM by inviting patients with KS to rate the phenomenological characteristics of their memories such as reliving, travel in time, remembering and realness. Besides this rating, memories were analyzed with regard to specificity. Analysis demonstrated lower sense of

reliving and memory specificity in patients with KS than in controls. According to this study [33], loss of specificity can be associated with a somatization of AMs, which itself leads to a shift from the ability to mentally relive past events to a general feeling of familiarity.

Together, research has demonstrated a lower general sense of reliving during autobiographical retrieval in patients with KS than in controls, even though these patients may attribute significant emotional value and importance to their memories [12, 33]. While this research throws some light on the subjective experience of AM in patients with KS, it does not delve into the nature of the emotional characteristics of autobiographical retrieval in these patients. Patients with KS generally demonstrate emotional disruption [52] such as apathy or irritability [53], as well as a tendency to overestimate the affective content of neutral stimuli [54]. Therefore, it would be of interest to evaluate whether the tendency of patients with KS to attribute high emotional value to their AMs mirrors an authentic subjective experience of the past or simply an overestimation of this value.

Regardless of emotion, little is known about the ability of patients with KS to retrieve and manipulate mental images (i.e., mental imagery) during autobiographical retrieval. Mental imagery contributes to several phenomenological properties of AM such as vividness [55, 56] and realness [57]. While there is a wealth of research demonstrating poor mental imagery during autobiographical retrieval in amnesia [58-61], little is known about this subjective experience in KS. One may expect poor visual imagery during autobiographical retrieval in patients with KS, this in light of a study by Robin, Moustafa [35] who have demonstrated relationship between autobiographical memory and performances of patients with KS on tasks of visual imagery [35]. While the study of Robin, Moustafa [35] has evaluated visual imagery with tasks such as the Taller/Wilder task (on which participants are asked to generate a mental image of an object

presented as a word and determine whether the object was taller than it was wide), this study did not evaluate the ability of patients with KS to generate visual images during autobiographical retrieval.

Finally, another subjective characteristic to be considered by future research is importance. While previous research has demonstrated that patients with KS tend to attribute high importance to their AMs [12, 33], the ability of these patients to retrieve self-defining memories has received little attention. This issue is discussed in the next section.

[Retrograde and anterograde autobiographical amnesia in KS](#)

The distribution of memory across the lifespan in KS has been investigated by research evaluating knowledge of public information (e.g., famous faces/news events) or even general semantic information (e.g., vocabulary words) [62]. However, that research will not be reviewed here as this paper deals with AM. Regarding AM, KS is mainly characterized by retrograde autobiographical amnesia (i.e., inability to retrieve old AMs). These difficulties were observed by Rensen et al [36] who observed retrograde amnesia for both episodic and semantic AMs in patients with KS. Besides retrograde autobiographical amnesia, KS is characterized by anterograde autobiographical amnesia (i.e., inability to form new AMs). These difficulties were observed in a study by Kopelman [9], who invited patients with KS to retrieve personal memories from their childhood, young adult and recent life. Results demonstrated significant difficulties in retrieving recent memories in KS (i.e., anterograde amnesia). They also demonstrated difficulty in retrieving childhood memories (i.e., retrograde amnesia), consistent with Korsakoff's [63] own observation that memory loss in KS may extend back many years or decades. This compromise in AM, as reported in the study by Kopelman [9], was observed in

another study demonstrating severe deficits in retrieval of memories from childhood, early adult and more recent life in patients with KS [64].

While research has demonstrated both retrograde and anterograde autobiographical amnesia in KS [9, 36, 64], there are still many open questions that need to be addressed. For instance, it is still unclear whether patients with KS may demonstrate anterograde amnesia, followed by retrograde amnesia, or vice versa. It is also unclear whether the anterograde amnesia in KS covers only a very recent period (e.g., the last month) or a longer interval (e.g., the previous year, or even the period following the syndrome). Critically, little is known about the reminiscence bump and self-defining memories in KS. This issue is important because self-defining memories have a large impact on the identity, and the study of these memories may significantly contribute to the understanding of the sense of self in patients with KS. Research may investigate self-defining memories based on models proposing an intimate relationship between these memories and identity [65, 66]. Therefore, at the clinical level, maintaining self-defining memories in patients with KS may contribute to maintaining their sense of personal identity and continuity in their own life story.

Taken together, patients with KS may demonstrate difficulties in retrieving recent and old memories, even though research in this area is scarce [9, 64] and there is need for more research on the distribution of AM in KS. The same applies for research on autobiographical confabulations in the syndrome.

[Autobiographical confabulations in KS](#)

Confabulations are a core clinical characteristic of memory difficulties in KS. Although these memory distortions have been extensively studied in KS, most research has evaluated them with item-memory tests. For instance, Kopelman [67] evaluated confabulations by measuring the

tendency of patients to produce intrusions while recalling previously read stories. In a similar vein, several studies have evaluated confabulations regarding intrusions on the California Verbal Learning Test (a word-list test) [68, 69]. Confabulations in KS have also been evaluated with the Dalla Barba Confabulation Battery [70] which contains subtests with questions assessing personal semantic memory (e.g., the patient's name, date and place of birth), previously experienced autobiographical events, general semantic memory questions (e., g, "What is the capital of the United Kingdom?"), and distractor questions that are logically coherent but refer to concepts or situations not based in reality. Using this battery, researchers have reported autobiographical confabulations in KS [71-74]. These confabulations have been attributed to mechanisms such as temporal confusion, i.e., the disturbed sense of time and temporal relations in memory, which may result from the inability to suppress previously activated, but currently irrelevant, memories [75]. However, the exact underlying mechanisms of confabulations in KS are still not fully understood. For instance, Kessels, Kortrijk [72] found no relationship between confabulations and deficits on executive function or deficits on source memory in KS. Similar findings were reported by Rensen, Oosterman [68], who found no relationship between caregiver-rated confabulations and measures of executive function. Confabulations in KS, however, can be attributed to imagination inflation, an effect which occurs when imagining an event that never happened and which may increase the tendency to falsely remember that it really occurred. Imagination inflation in KS was assessed in a study in which patients with KS were invited to imagine performing actions (e.g., "hold the pen") once or three times [35]. Afterward, participants had to decide whether actions were previously imagined or enacted. Results demonstrated that repeated imagining performing actions (i.e., imagination inflation) increased the tendency of both patients with KS and controls to falsely recall the actions as having been enacted (i.e., confabulations).

In our view, future research can contribute to the understanding of autobiographical confabulations in KS by assessing the putative relationship between these distortions and the principles of coherence and correspondence. As previously mentioned, while correspondence operates to make memories correspond to the original experienced event, coherence operates to make memories consistent with our current beliefs and goals. These two principles are not mutually exclusive; rather, a balance between them is required for normal functioning of AM [3]. Confabulations can result from a misbalance in which coherence overcomes correspondence. In other words, patients with KS may produce confabulations to support objectives and beliefs (i.e., high coherence), with little regard for the correspondence between the constructed memory and reality (i.e., low correspondence). This assumption is supported by the view that memory retrieval (in everyday life) is to some degree false, and that retrieval does not operate to represent past experience literally but rather to generate personal meanings [3]. In our view, confabulations in KS may be considered not as memory failures but rather as a mechanism with considerable benefits, particularly in maintaining a coherent sense of the self. In other words, confabulations, with all their inferred and intrusive details, may serve an adaptive function by supporting coherence of the self in patients with KS.

Confabulations in KS may not only serve to support coherence of the self but also social purposes. One purpose of memory in general is to share personal experiences with others [1]. Thus, confabulations may be regarded as a tendency of patients with KS to produce stories to share with others, or even to generate and embellish their memories rather than construct a strictly accurate representation of what happened. This tendency may be specifically observed with provoked confabulations, as the latter are typically produced in response to questions arising during social interactions. In this view, confabulations may serve the purpose of narrative coherence by which unrelated, or even incoherent, memories are constructed to answer a social

demand or simply to share personal experiences with others. The social purpose of confabulations, as suggested in this review, can be supported by a study demonstrating significant correlations between confabulations and social loneliness and lack of visits from friends/family [76].

Overall, while confabulations can be considered as a key symptom of autobiographical dysfunction in KS, little is known about the exact underlying mechanisms of these memory distortions. The present paper proposes a hypothesis according to which confabulations in KS are produced to support self-coherence or even social coherence. In this view, confabulations are ultimately about gathering multiple episodes into a coherent memory that explains patients' self-images or life trajectory. While this hypothesis may have important implications in the understanding of confabulations in KS, empirical research is required to test this hypothesis.

Summary and concluding comments

AM has a special status in the study of memory because it not only reveals what or how much we remember but, critically, why and how we do it. Research on AM, as reviewed here, demonstrates how patients with KS suffer difficulties in retrieving and reliving specific memories or even in retrieving memories from different life periods. However, while research has documented these difficulties, little is known about how patients with KS experience their emotional state, or how they generate mental images, during autobiographical retrieval. Regarding the distribution of AM, although research has demonstrated difficulties in retrieving recent and remote memories in patients with KS, little is known about their ability to retrieve memories from the reminiscence bump, and especially self-defining memories. Another issue to be considered by future research is the exact underlying mechanism of confabulations. However,

as proposed by this paper, this research can test the hypothesis that patients with KS may produce confabulations in order to support self- or social coherence.

Clinical research is also needed to propose and validate rehabilitation programs for autobiographical memory in KS, building on previous research in this field. For instance, Svanberg and Evans [77] trained autobiographical memory in a patient diagnosed with KS by means of reviewing images as previously recorded by a wearable automatic camera. The patient showed improved recall for events recorded using the camera as well as improved subjective ratings of identity. Future clinical research can replicate the study of Svanberg and Evans [77] on larger sample sizes. Clinical research can also build a study demonstrating that showing an instructional video demonstrating prospective intentions (i.e., a video of a person completing the prospective task) improved prospective memory in patients with KS [78]. This study, with other research [79, 80], demonstrate how technological tools can be used in memory rehabilitation in patients with KS.

Clinical research can also address autobiographical memory in patients with KS with regard to reminiscence therapy, which includes activities such as autobiographical writing, storytelling, family genealogy and scrapbooks [81]. While there is a body of research on this therapy in amnesia [82], the effects of reminiscence in KS are poorly understood. Clinical research can also draw on a study demonstrating the beneficial effects of the retrieval of self-related information on AM in patients with KS [34]. In that study, patients with KS were invited to retrieve AMs after providing statements to the question “Who am I?” and after a control condition consisting of verbal fluency. Results demonstrated higher autobiographical specificity in the “Who am I?” condition than in the verbal fluency condition. Therefore, a simple task (i.e., “Who am I?” statements) may serve as a tool to cue autobiographical retrieval in patients with

KS. Another suggestion for future research is to study the relationship between AM and future thinking, as AM allows people to retrieve and flexibly recombine information from past experiences into novel representations of events that may happen in the future [83]. A recent study investigating the relationship between past and future thinking by inviting patients with KS to retrieve AMs and to construct future events, results demonstrated that specificity was low for both past and future thinking [11]. According to this study, diminished future thinking in patients with KS can be attributed to difficulties in recombining information from past experiences into novel future scenarios. While the study offers an insight into the relationship between past and future thinking in KS, the quest to unravel future thinking in KS is in its infancy with many questions remaining unanswered, such as the relationship between future thinking and planning or problem-solving in the syndrome.

To conclude, AM basically serves to support the self and to serve social and narrative functions. By studying AM in KS, we will come to understand how patients retrieve or create memories to support their sense of self. We will also grasp how they retrieve or create memories to construct and transmit their life story.

Conflict of interest

The author declares no conflict of interest

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