

## Retrograde episodic memory and emotion: A perspective from patients with dissociative amnesia

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### ABSTRACT

With his recent definition of episodic memory Tulving [Tulving, E. (2005). Episodic memory and auto-noesis: Uniquely human? In H. Terrace & J. Metcalfe (Eds.), *The missing link in cognition: Evolution of self-knowing consciousness* (pp. 3–56). New York: Oxford University Press] claims that this memory system is uniquely human and thereby distinguishes human beings from other, even highly developed, mammals. First we will define the term episodic memory as it is currently used in neuropsychological research by specifying the three underlying concepts of subjective time, auto-noetic consciousness, and the self. By doing so, we will strongly focus on retrograde episodic memory and its relation to emotion and self-referential processing. We support this relation with a discussion of autobiographical memory functions in psychiatric disorders such as dissociative amnesia. To illustrate the connection of emotion and retrograde episodic memory we shortly present neuropsychological data of two cases of dissociative amnesia. Both cases serve to point to the protective mechanism of a block of self-endangering memories from the episodic memory system, often described as the mnestic block syndrome. On the basis of these cases and supportive results from further cases we will conclude by pointing out similarities and differences of patients with organic and dissociative (psychogenic) amnesia.

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### 1. Introduction

On a content-based view, memory can be seen as a multidimensional concept. With respect to the kind of processed information long-term memory can be demarcated into four (Markowitsch, 2000a; Tulving, 1987), recently into five different memory systems: procedural memory, priming, perceptual memory, semantic, and episodic memory (Markowitsch, 2003; Reinhold, Kuehnel, Brand, & Markowitsch, 2006). These systems are hierarchically ordered with episodic memory at the top (cf. Fig. 1), reflecting their ontogenetic and phylogenetic development. Tulving (1995, 2001) emphasized in his *SPI*-model that encoding of information occurs *serially*, storage in *parallel*, and retrieval is *independent* of the condition during encoding, implying that information, encoded as an episode, may be retrieved on the basis of the procedural memory system.

Introducing the term 'episodic memory' in the early 1970s of the last century, Tulving (1972) summarized the ability to recall events of one's own life with a strong relation to time and space and with a clear emotional connotation. Tulving thereby extended Nielson's (1958, p. 25) view of 'two separate pathways for two kinds of mem-

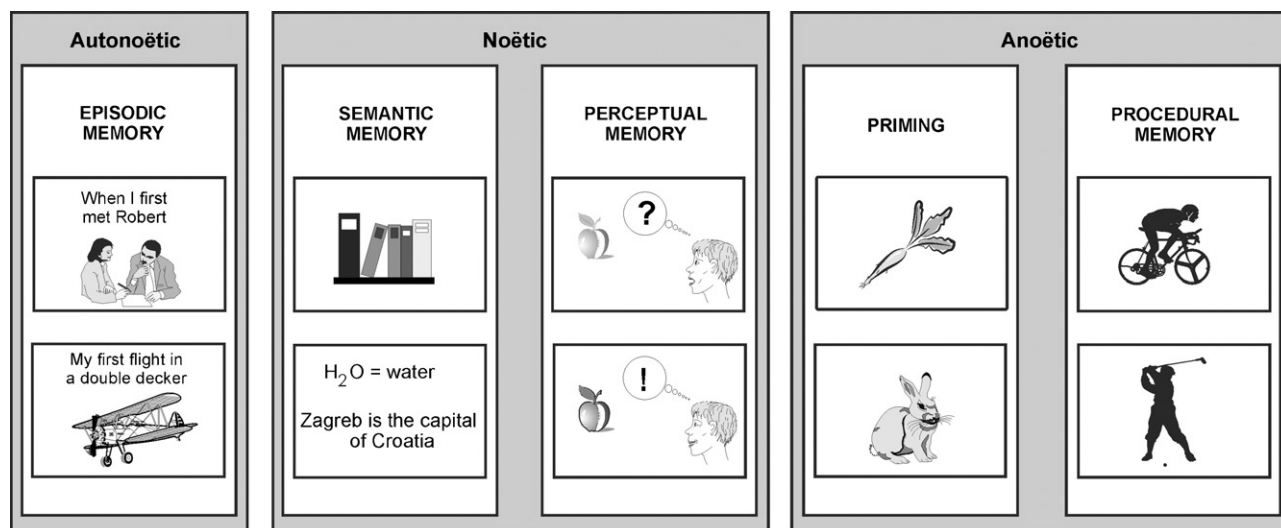
ories. The one is memories of life experiences centering around the person himself and basically involving the element of time. The other is memories of intellectually acquired knowledge not experienced but learned by study and not personal'. In a relatively young science like the neurosciences and neuropsychology those definitions commonly change and are refined throughout the research process. With respect to Tulving's early definition, some researchers used the term 'episodic memory' for word-list paradigms in laboratory tasks.

This and other observations led Tulving (2005) to a renewal and redefinition of his episodic memory definition. Currently, episodic memory is characterized as a conjunction of three concepts, namely subjective time, auto-noetic consciousness, and the experiencing self. With this definition Tulving stresses the importance of the self-relatedness of episodic memories. This is supported by the results of Gilboa (2004) who reviewed prefrontal cortex activation in laboratory word-list paradigms and autobiographical memory tasks. Although detecting overlapping activations for both tasks he was able to also reveal differential activation pattern in ventromedial (primary left-sided) prefrontal activations that are solely associated with autobiographical memory retrieval. It is concluded that both memory retrieval processes can be differentiated with regard to their modes of post-retrieval monitoring and verification. Whereas pure autobiographical-episodic memory retrieval induces an intuitive 'feeling of rightness' and a relation to an activated self-schema, retrieval of episodic memories (e.g., word lists)

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**Fig. 1.** Sketched pictograms to exemplify the five content-based divisions of long-term memory with their corresponding levels of consciousness. The memory systems are hierarchically ordered with procedural memory as the hierarchically lowest memory system (right) and episodic memory at the top (left).

requests a more conscious and sophisticated monitoring (Gilboa, 2004).

Taking into account the discussion of episodic word-list learning and autobiographical-episodic memory, Tulving (2001) also strictly differentiates between the terms 'remember' and 'know'. To 'remember' a specific event means that the memory has a strong self-relation (autonoësis) and emotional connotation and thereby goes far beyond of just 'knowing' that this event occurred (see also Gardiner & Richardson-Klavehn, 2000). For this reason, the distinction of 'remember' and 'know' is often part of studies dealing with autobiographical memory. For instance, Piolino et al. (2007) used the remember/know paradigm to detect developmental differences between semantic and episodic subcomponents of autobiographical memory in school-age children. With the age of the children the 'remember' responses which were justified by contextual information of the event increased. Thus, Piolino and colleagues concluded that the ability of mental time travelling in subjective time is the last feature of the autobiographical memory system that becomes fully operational.

Tulving argues that remembering is a central function of episodic memory and thereby distinguishes this memory system from semantic memory. The experiencing person – the mental-time traveller – is referred to as the 'rememberer'. Autobiographical memory is often used synonymously for episodic memory though it needs not to be same as autobiographical memory additionally comprises autobiographical-semantic facts (e.g., date of birth). Cabeza and St Jacques (2007) illustrated in their recent review article of functional neuroimaging of autobiographical memory a continuum from the purest episodic to the purest semantic memory. This also reflects the discussion of a possible distinction of semantic and episodic subcomponents constituting autobiographical memory. Retrieving facts related to one's own biography, like date and place of birth, relates to the semantic portion of autobiographical memory since we 'know' and do not 'remember' these facts. In contrast, when we 'remember' a specific personal event like our last birthday party, the memory is associated with a clear emotional connotation and further perceptual features like the taste of our birthday cake. These features make the difference to just knowing where the party took place and who baked the cake. The usage of the term 'autobiographical-semantic memory' when relating to self-related facts and semantic knowledge and 'autobiographical-episodic memory' when talking of specific self-

related and emotionally laden events reflects this segregation. Both subcomponents (autobiographical-semantic and autobiographical-episodic) contain self-related information but their contents differ concerning their emotional colouring. Thus, self-related and emotional processes are separable when looking at autobiographical memory. To judge whether this hand belongs to me or another person is a clearly self-related but un-emotional decision. In the following we will use the term episodic memory when referring to memories of the autobiographical-episodic memory system, since episodic memory as defined by Tulving (2005) still constitutes the core facet of autobiographical memory.

Returning to Tulving (2005) definition, we will have a closer look at the three concepts constituting episodic memory: subjective time, auto-noetic consciousness, and experiencing self.

Tulving's concept of 'subjective time' enables the 'rememberer' to mentally travel to any given point of his or her individual lifeline. It is also referred to as chronesthesia (Tulving, 2002). With the term 'subjective time', Tulving highlights the fact that the time in which events are remembered differs from physical time. Though episodic memory is often related to the past it also enables us to anticipate future events and consequences or needs. The ability of prospective mental time travelling is subject of some recently published papers (e. g., Addis, Wong, & Schacter, 2007; Buckner & Carroll, 2007; Szpunar et al., 2007) and is currently defined by: "allows us not only to go back in time, but also to foresee, plan, and shape virtually any specific future event" (Suddendorf & Corballis, 2007, p. 1; see also Tulving & Kim, 2007). However, in this manuscript we will focus on retrograde episodic memory and therefore on the past-related aspect of mental time travelling.

The second concept, in which episodic memory is embedded, is auto-noetic consciousness. Related to each of the above-introduced five content-based memory systems there are corresponding levels of consciousness. Procedural memory and priming as the hierarchically lowest memory systems remain on an 'anoetic' level of consciousness, meaning that processed information is not subject to conscious attention. The perceptual and semantic memory systems require mindful processing of information what is referred to as 'noetic' consciousness. Forming or retrieving episodic memories involves self-related and thus 'auto-noetic' information processing. Tulving (2005) considers auto-noetic consciousness to be a uniquely human trait. The corresponding levels of consciousness can also be derived from Fig. 1. Auto-noetic (self-)consciousness is defined as

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