



Episodic memories

Martin A. Conway

The Leeds Memory Group, Institute of Psychological Sciences, University of Leeds, Leeds LS2 9JT, England, United Kingdom

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ABSTRACT

An account of episodic memories is developed that focuses on the types of knowledge they represent, their properties, and the functions they might serve. It is proposed that episodic memories consist of *episodic elements*, summary records of experience often in the form of visual images, associated to a *conceptual frame* that provides a conceptual context. Episodic memories are embedded in a more complex conceptual system in which they can become the basis of autobiographical memories. However, the function of episodic memories is to keep a record of progress with short-term goals and access to most episodic memories is lost soon after their formation. Finally, it is suggested that developmentally episodic memories form the basis of the conceptual system and it is from sets of episodic memories that early non-verbal conceptual knowledge is abstracted.

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Tulving's concept of *episodic memory* is principally about a type of *memory system* (Tulving, 1983, 1985a). Understanding episodic memory as a system is unquestionably important (Schacter & Tulving, 1994). There are, however, other valuable questions that can be asked here too and some of these relate to episodic memories *as memories*. That is, as mental representations with distinct properties, organization in long-term memory, and which are manifest in particular brain circuits. These features are considered in the sections that follow, in the spirit of Tulving (1983), and they lead to proposals about the ontogeny and phylogeny of episodic memory more generally.

1. Properties of episodic memories

Table 1 lists nine properties of episodic memories that collectively distinguish them from other types of memory representations. Note that, it is the combination of these features that are proposed as defining. Other types of long-term memory representations may feature one or several of the properties but only episodic memories have all nine properties. These properties are now considered in further detail, as are some of the issues they raise for the study of episodic memories.

The first property in Table 1 captures the idea that episodic memories are *summary* records of experience. That is to say that they are experience-near and correspond to experience but they are not literal records of experience. In certain special cases, memory for highly self-relevant self-defining moments for instance, they may

contain fragments that are close to being literal, veridical, records of experience. Something like this appears to occur in, for example, memory for trauma, (see Holmes, Grey, & Young, 2005) when highly specific details are retained. These can take various forms, for example a vivid recollection of the texture of the material on a car door that a road traffic accident victim looked down on to avoid witnessing the head on impact of an oncoming vehicle, a blue flash of light when an electric cable snapped as a train derailed, the thought a person had during a traffic accident, and so on (see Conway, Meares, & Standart, 2004). Some caution must be exercised here as it is also the case where such details can be incorrect too – the only point is that some are correct and appear to be very close to actual experience, they can also cause an intense feeling of reliving when brought into consciousness. Vivid details like these are also often reported for less traumatic but nonetheless highly personally important self-defining experiences and for memories of significant public events, so called 'flashbulb' memories (see Conway, 2005; Conway & Pleydell-Pearce, 2000; Conway, Singer, & Tagini, 2004, for reviews). Again, these too may not always derive from external experience and, as with all episodic memories, they are also associated with more conceptual knowledge. In general, however, it is suggested that episodic information is more summarized and generic, more *representative* of an experience than it is a literal record. This proposal raises interesting questions that research has yet to address. For instance, how is experiential processing transformed into episodic information? I think it fair to note that currently we have very little idea, and even less evidence, about how this transformation takes place. Baddeley's (2001) notion of an episodic buffer in working memory constitutes one promising approach to this question. Another thinking about the role of hippocampal processes in configuring knowledge and generating

E-mail address: M.A.Conway@leeds.ac.uk.

Table 1
Nine properties of episodic memories.

1. Contain summary records of sensory-perceptual-conceptual-affective processing.
2. Retain patterns of activation/inhibition over long periods.
3. Often represented in the form of (visual) images.
4. They always have a perspective (field or observer).
5. Represent short time slices of experience.
6. They are represented on a temporal dimension roughly in order of occurrence.
7. They are subject to rapid forgetting.
8. They make autobiographical remembering specific.
9. They are recollectively experienced when accessed.

associations (Squire, 1992) is also highly relevant. Nevertheless exactly how knowledge is extracted from experience and represented in an episodic memory is unknown (but see Moscovitch, 1995, for a particularly interesting account). Although it seems that in everyday experience this is a largely non-conscious process and not within intentional control.

Interestingly, much the same might be said about property two in Table 1 which focuses on the fact that once an episodic memory is formed, episodic information (episodic detail) within the memory is differentially accessible. Racsmany and Conway (2006) developed this idea in a series of experiments that showed that items that were inhibited and therefore difficult to access were only inhibited in an episodic memory of their acquisition. The same items if accessed in conceptual, non-episodic, representations were either not inhibited or were primed. Thus, somewhat paradoxically the same item can be simultaneously inhibited (in its representation in an episodic memory) and primed (in its representation in conceptual knowledge structures). This pattern was termed *episodic inhibition*. Episodic inhibition captures the idea that in any episodic memory there is a pattern of activation/inhibition over the contents of the memory and it is this pattern that determines the accessibility of episodic details: inhibited details are difficult to access and activated details have their access facilitated. The activation/inhibition levels of details in an episodic memory are probably determined by many factors, although we have suggested that the goal structure of an experience may be critical in that it drives attention, action, and affect, and must thereby influence encoding processes, cf. Conway (2005). Indeed, one of the main functions of episodic memories might be to keep a highly specific record of aspects of experience relevant to recent goal processing (Brewer & Dupree, 1983; Lichtenstein & Brewer, 1980; Williams, Conway, & Baddeley, 2008). Being able to remember in a relevant way, rather than literally, what has been recently said and/or done is critical to focussed and fluent everyday cognition and action: exactly the type of relatively routine daily behaviour that patients with, for example, anterograde amnesia can find so difficult. Details in an episodic memory are then at different levels of accessibility. Some of these levels will be preset by encoding others will emerge over repeated episodes of accessing a memory and yet others will be determined the nature of the search and cues that feature in it. A question of considerable interest here is: What in memory represents the boundaries of an episodic memory? Indeed, boundaries must be especially important as they separate memories into discrete entities and because of that are, presumably, highly available. Unfortunately relatively little is known about this (see Williams et al., 2008, for some recent findings).

Properties 3, 4, and 5 in Table 1 concern the nature of episodic memories. It has long been known that episodic memories are dominated by imagery and particularly by visual imagery (Brewer, 1988; Galton, 1883). Indeed, brain damage that leads to the loss of the ability to generate visual images may as a secondary consequence give rise to retrograde amnesia (Conway, 1996, 2005; Rubin & Greenberg, 1998). This type of retrograde amnesia is marked by a lack of specificity in memory although more general knowledge

of the patient's life is often retained (Conway, 1996, 2005). Visual images contain information that is configural. That is to say that the objects represented in a visual image are represented in relation to each other and because of this visual images may maximize the amount of information they contain (Conway, 1988). The contents of a visual episodic image may be highly sensitive to visual cues that can activate the image, either by some direct mapping from cue to image content or, perhaps, by some mapping onto relations configured in the image. As visual processing is so central to human cognition it follows that visual episodic images are probably being accessed a great deal of the time (although they do not necessarily enter conscious awareness) and are generally highly responsive to visual cues.

Interestingly, it seems that visual episodic memories always have a perspective. This was first noticed by Henri and Henri (1898), further developed by Freud (1915), and reintroduced into modern memory research by Nigro and Neisser (1983); see too (McIsaac & Eich, 2002; Robinson & Swanson, 1993). In the modern parlance memories are said to have a 'field' or an 'observer' perspective (Nigro & Neisser, 1983). A visual episodic memory with a field perspective is considered to preserve a person's original perspective or something approximating to that perspective. In contrast in a visual episodic memory with an observer perspective the rememberer looks into the memory and sees themselves in the memory. Although systematic properties of field and observer memories have been investigated, for example field memories have been found to be more strongly associated with recollective experience than observer memories (Libby & Eibach, 2002; McIsaac & Eich, 2002), and recent memories are more likely than older memories to be retrieved with a field perspective (Robinson & Swanson, 1993), there remain interesting aspects of episodic perspective yet to be investigated. In our laboratory for instance we have often asked our participants when they reported observer memories: what do you look like? The answers are surprisingly varied. For memories from childhood a representation of themselves from a photograph is often reported or a sort of stereotyped image is described. For memories some years old but not from childhood the image of the self in observer memories is frequently a generic image rather than a specific image from a unique moment. For more recent memories the images of the self in a memory are more frequently episodic than generic. In contrast we found field perspective to be less varied. It seems, as Freud (1915) originally noted, that the observer perspective in an episodic memory indicates more memory construction and the incorporation of other knowledge into an episodic memory. That this appears to occur for older compared to recent memories perhaps indicates a slow integration of episodic memories with more generic and conceptual autobiographical knowledge.

Episodic memories, especially visual episodic memories, represent short time slices of experience (Anderson & Conway, 1993; Neisser & Harsch, 1992; Williams et al., 2008). It is, however, neither known how this occurs nor what the nature of these time slices is. We have proposed that the boundaries of episodic memories are marked at the opening boundary by information about actions and at the closing boundary by facts that are often details about the outcomes of actions (Williams et al., 2008). This is consistent with our more general view that episodic memory and autobiographical knowledge are about goals. That is to say they preserve information that is highly relevant to goal processing including goal generation, plan execution, outcomes and evaluations (for related views see Brewer & Dupree, 1983; Lichtenstein & Brewer, 1980). We have suggested that one function of episodic memories is to provide a means to accurately check on recent progress with current goals, i.e. in the preceding few minutes, hours, days, or last few days. In providing this detailed record of progress with very specific goals episodic memory also forms the basis for future goals and plan-implementation. Tulving (2002) has pointed to the impor-

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