



## Looking for episodic memory in animals and young children: Prospects for a new minimalism

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### ABSTRACT

Because animals and young children cannot be interrogated about their experiences it is difficult to conduct research into their episodic memories. The approach to this issue adopted by Clayton and Dickinson [Clayton, N. S., & Dickinson, A. (1998). Episodic-like memory during cache recovery by scrub jays. *Nature*, 395, 272–274] was to take a conceptually minimalist definition of episodic memory, in terms of integrating information about what was done where and when [Tulving, E. (1972). Episodic and semantic memory. In E. Tulving, & W. Donaldson (Eds.), *Organisation of memory* (pp. 381–403). New York: Academic Press], and to refer to such memories as ‘episodic-like’. Some claim, however, that because animals supposedly lack the conceptual abilities necessary for episodic recall one should properly call these memories ‘semantic’. We address this debate with a novel approach to episodic memory, which is minimalist insofar as it focuses on the non-conceptual content of a re-experienced situation. It rests on Kantian assumptions about the necessary ‘perspectival’ features of any objective experience or re-experience. We show how adopting this perspectival approach can render an episodic interpretation of the animal data more plausible and can also reveal patterns in the mosaic of developmental evidence for episodic memory in humans.

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About the most profound result of the conceptual revolution set in train by Endel Tulving’s introduction of the notion of episodic memory (Tulving, 1972) was that it revived the scientific study of experience, as opposed to behaviour and representation. This is because episodic memory is essentially the re-experiencing of a situation. Adult humans can, of course, report on their experiences and can indeed judge whether they simply know something or whether they can recollect experiencing it (Gardner, 1988; Tulving, 1985). But how should this reintroduction of experience impact upon the scientific study of animals and young children? This is the question we shall tackle in our paper, by examining the implications for a new form of minimalism about episodic memory for comparative and developmental psychology. First, we need to explain what is intended by the term minimalism.

The original definition of episodic memory offered by Tulving is an example of conceptual minimalism, in our terms. For, to say that “Episodic memory stores and retrieves information about temporarily-dated episodes or events, and temporal–spatial relations among events (Tulving, 1972, p. 385) and that “To ask a person about some item in episodic memory means to ask him when did event *E* happen, or what events happened at time *T*” (Tulving, 1972, p. 388) would seem to be to omit a lot of what is seemingly

essential to human episodic memory in terms of subjective experience and of conceptual abilities. Of course, over the years Tulving (1983, 1985, 2000, 2002, 2005) has added layers to this minimalism until it contains all one could desire in terms of phenomenal and conceptual richness: “[Episodic memory] is probably unique to humans. It makes possible mental time-travel through subjective time—past, present and future. This mental time travel allows the “owner” of the episodic memory (“self”), through the medium of auto-noetic awareness, to remember one’s own previous “thought about” experiences. . .” (Tulving, 2005, p. 15).

Meanwhile, over in developmental psychology, Josef Perner has stressed both the necessary contribution to episodic memory of the theory-like ability to appreciate how past perceptual experiences can cause current knowledge (Perner, 2001) and the role of introspective abilities that are similarly theory-like (Perner, Kloo, & Stöttinger, 2007). This too is a far cry from the minimalism of the early 1970s.

What, then, is the empirical cash-value of the early minimalism espoused by Tulving and later denied by theorists such as Tulving and Perner? It is that if an organism, not necessarily a human adult, can recall *what* happened *where*, and *when* (a WWW memory) then it has achieved episodic recall. According to one of us, this implication follows from the kind of 1972 definitions quoted here (Clayton & Dickinson, 1999); and the legitimacy of this reading has never been challenged by Tulving. Indeed he has acknowledged that “Nicola Clayton’s scrub-jays would have been certified as

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full-fledged episodic creatures back in 1972” (Tulving, 2005, p. 47). It goes without saying, that this view of episodic memory does *not* invite the phrase ‘is probably unique to humans’.

Given this background, it is not surprising that there is currently an impasse between those who argue that the existence of WWW memories in animals (in Western Scrub-Jays in particular) means that they possess episodic memories, and those who believe that we should take episodic memory to mean just what Tulving’s later elaborations of it mean (principal members of the latter camp are Suddendorf and Corballis, and Tulving and his collaborators; e.g. Suddendorf & Corballis, 1997, 2007; Tulving, 2002, 2005). Meanwhile, enthusiasts for the minimalist definition can reply that there is no reason why one may not prefer a psychologist’s earlier phase of theorising to later ones, and that indeed we have witnessed this in Hulme and Mackenzie (1992) on Baddeley’s model of working memory and Pinker and Jackendoff (2005) on Chomsky’s theory of syntax.

But the sceptic will reply, in turn, that it is not just a question of early versus late-phase theorising, because there is a very good reason why Tulving made the theoretical elaborations he made, namely, in order to capture these additional features of human episodic memory. It is one thing to use the empirical framework afforded by the 1972 definition to collect evidence for ‘episodic-like’ memory (Clayton & Dickinson, 1998; Clayton, Bussey, & Dickinson, 2003) but quite another to refer to the jays’ performance in terms of ‘mental time travel’.

We feel, however, that the enthusiast’s reply is a strong, if not unanswerable, one. Episodic memory involves an organism re-experiencing an earlier situation. Given this, it stands to reason that *just as human episodic memory will inherit what is present in human experience, so will avian episodic memory inherit the character of avian experience*. It is a datum that human experience takes place within a background of self-awareness and networks of conceptual abilities, while it is our best bet that avian experience does not do so, or at least does so to a lesser extent. Therefore, we should adopt a minimalist *non-conceptual* account to study avian episodic memory.

In itself, however, this answer will not allow an escape from the impasse, mainly because it is so easy to describe WWW memories in semantic terms, that is, in terms of the animal just *knowing* what was hidden where and when as opposed to re-experiencing the caching event. But we believe the case for a minimalist account of episodic memory has been made, if we are serious about the very possibility of its existing in animals. Our aim, then, is to introduce a new form of minimalism. In later sections we shall describe this and then show how it can be applied to some current developmental data. All we will say about it for now is this: Our form of minimalism claims as a necessary component of episodic memory in all creatures, and perhaps as a sufficient condition for episodic memory in animals, that the organism re-experiences a perceptual relation between itself and data of some kind. We call this a “perspective”; and hence use the term *perspectivism*. This relation is most naturally understood in the case of spatial coding, but it also exists in terms of temporal relations and can also be easily appreciated with respect to modal relations.

We shall elaborate this claim in Section 2. In fact, the following issues will be covered in this paper.

1. A review of the evidence for episodic memory in animals, with particular attention to the WWW experiments.
2. Minimalism explained. We discuss the meaning of “non-conceptual content” in relation to episodic memory, and set out the perspectivism thesis, describing its roots in Kantian theory.
3. The implications of the perspectivism thesis for the development of episodic memory are followed through. The discussion of how

episodic cognition can be assessed in children will illustrate the empirical cash-value of the thesis, because in some developmental tasks perspectivism has been assessed and in others it has not.

4. We take stock and also sketch some novel tasks that could be given to children and animals in order to directly assay the perspectival nature of their memory traces.

## 1. Episodic memory in animals

As discussed earlier, Clayton and Dickinson (1998), following Tulving’s (1972) early minimalist definition of episodic memory, considered cases in nature in which an animal will benefit from the capacity to remember a specific past episode of what happened where and when. One example concerns members of the crow family, which like other food-caching animals, hide or cache food, and rely on memory to recover these food caches at a later date (see Clayton, Griffiths, Emery, & Dickinson, 2001 for other examples of potential candidates of episodic-like memory in nature). Given that these birds rely on their caches for survival in the wild, it seems likely that the selection pressure for remembering which caches were hidden where and how long ago would have been particularly strong (Griffiths, Dickinson, & Clayton, 1999), particularly since they cache year round (Curry, Peterson, & Langen, 2002). These birds also cache reliably in the laboratory, providing both ethological validity and experimental control (Clayton, 1999).

Clayton and colleagues focused on the behavioral criteria for episodic-like memory, namely that the animal must be capable of remembering what happened where and when on the basis of a single past experience, and in a way that cannot be explained in terms of relative familiarity. To do so they focused on one particular species of crow, the western scrub-jay. In order to test whether these food-caching jays could remember the what where and when of specific caching events, Clayton & Dickinson (1998) capitalized on one feature of the scrub-jays’ ecology, namely the fact that these birds cache perishable food items such as worms and other invertebrate prey as well as non-degradable nuts and seeds, and as they do not eat rotten items, recovering perishable food is only valuable as long as the food is still fresh. Consequently, the jays might need to remember not only where they have cached, but also which foods are perishable and how long ago they hid them. At this point it is also worth noting that not all food-caching animals hide perishable items. Grey squirrels, for example, avoid the problem of perishability that the jays have by removing the cotyledon from acorns before they cache them, and this prevents the nuts from germinating and thus spoiling as a food source (Steele, Turner, Smallwood, Wolff, & Radillo, 2001).

In order to test whether these birds remember the what where and when of specific caching episodes, the jays were given a series of trials in which they could cache their preferred food ‘wax worms’ and the less preferred peanuts in two sand-filled ice cube trays, both of which were made visuo-spatially distinct and trial-unique by attaching Lego Duplo® blocks to the sides of the trays (Clayton & Dickinson, 1998). The birds were given the opportunity to cache in different pairs of trays on different trials so that each caching episode was unique. Although the birds had no cue predicting whether or not the wax worms had perished other than the passage of time that had elapsed between the time of caching and the time at which the birds could recover the caches they had hidden previously, the birds rapidly learned that wax worms were fresh when recovered 4 h after caching, whereas after 124 h, the worms had decayed. Consequently, the birds avoided the worm caches and instead recovered exclusively peanuts. It was because the animals had been hand-raised, and we therefore knew their precise reinforcement histories, that we could be certain that they had no prior experience of degrading worms.

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