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Learning From the Past:
Epistemic Generativity & The Function of Episodic Memory

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Abstract: I argue that the function of episodic memory is to store information about the past, against the orthodox view that it is to support imagining the future. I show that episodic memory is epistemically generative, allowing organisms to learn from past events retroactively. This confers adaptive benefits in three domains: reasoning about the world, skill, and social interaction. Given the role of evolutionary perspectives in comparative research, this argument necessitates a radical shift in the study of episodic memory in nonhumans.

1. Why do we remember? The answer might seem obvious: memory confers an advantage by storing information which we can exploit as we navigate the world. This answer provides a compelling explanation for the existence of semantic memory: the store of general knowledge about the world. It is obvious that having a store of knowledge – about where things are, which things are dangerous, who our friends are and so on – is adaptive. But it is less obvious that this explains the existence of episodic memory – memory for personally experienced past events. What is the use in retaining information about particular past events, 'given that those events will never come again?' (Hoerl & McCormack, 2016, p. 241).

An increasingly orthodox answer to this question is that there is no real benefit to remembering the past. What explains our capacity to episodically remember is instead that it enables us to imagine the future (e.g. Clayton & Wilkins, 2018; Klein, 2013; Schacter, Addis, & Buckner, 2007; Suddendorf & Corballis, 2007; Tulving, 2005). On this view, episodic memory and imagining the future are exercises of a single evolved system for 'mental time travel' – for imaginatively projecting oneself into the past and the future. The function of this system lies in its future-oriented manifestation: it enables us to imaginatively simulate future events, and thereby to more effectively anticipate and plan for the future. Episodic memory is merely a design feature of the system, providing the raw materials out of which future-directed simulations are constructed.

This view of episodic memory's function receives some support from neurology and psychopathology. Episodic recollection and future-directed imagining activate substantially overlapping brain areas (Schacter et al., 2007), and impairments in episodic memory are comorbid with impairments in future-directed imagination (Klein, Loftus, & Kihlstrom, 2002; Rosenbaum et al., 2005). But the force of this evidence should not be overstated. Whilst it is clear that episodic memory and imagining the future are closely connected, other evolutionary stories are clearly compatible with what we know. For instance, perhaps episodic memory emerged independently, giving rise to mechanisms that were later co-opted for mental time travel. This gradualist picture seems plausible, would predict the same pattern of neurological overlap and comorbidity, and would explain why, despite being error-prone, episodic memory seems nevertheless to be reliable – something the orthodox view renders mysterious (Mahr & Csibra, 2018). But of course, episodic memory could have emerged independently only if there

is some independent benefit to the organism in remembering past events – which, according to the consensus, there is not.[1]

I argue that this is a mistake. Episodic recollection confers substantial benefits on an organism, independently of its role in future-oriented mental time travel. I begin by highlighting a distinctive way in which episodic memory is epistemically generative: it enables organisms to learn from events even after those events are concluded. Learning from the past in this way confers adaptive benefits in three domains: reasoning about the world, skill and social interaction. So, the function of episodic memory is importantly backward-looking. I close by arguing that this necessitates a radical shift in the study of episodic memory in comparative psychology.

2. Episodic recollection involves 'reliving' or 're-experiencing' past events (e.g. Tulving, 2005) – bringing rich, contextual representations of past events before the mind, replete with perceptual, spatial, temporal and first-personal detail. As such, episodic memory often records information to which the subject did not attend at the time of the remembered event, or whose apparent significance at the time of the event was minimal. This feature of episodic memory is exploited by the 'unexpected question' task, used to detect episodic memory in children (Cheke & Clayton, 2015). The idea is that answering unexpected questions about an event is a sign that subjects do not simply extract important information from the event and store it in semantic memory, but instead retain an episodic memory of the event, from which they can retroactively extract information.

This reveals an interesting way in which episodic memory is epistemically generative. That is to say, one can come to know more on the basis of an episodic memory than one knew at the time of the remembered event.[2] Jennifer Lackey (2005) describes one such case, involving a driver who does not notice during his commute that construction has begun on an adjacent freeway. Later, when asked about the freeway, he recollects the morning's commute, realises that the freeway is under construction, and resolves to avoid it. This last point is important: because the driver can recall this event and form new beliefs on the basis of the memory, he is able to make more effective decisions about what to do next. In an important and valuable sense, his memory enables him to learn from the past.

Another class of cases in which episodic memory facilitates this sort of retroactive learning are ones in which the subject fails to understand or appreciate something at the time of the event, but where her epistemic position later shifts, so that she can come to know on the basis of her memory things that she could not have known before. Take, for instance, the occasion when, as a child of about six, I announced to a group of adults 'I've been bitten by a midget!', believing this to be the term for a small biting insect. I could not understand why they laughed. Years later, I remembered this episode and knowing, by then, that 'midget' is a somewhat offensive term for a person of unusually short stature, I laughed too. I knew at that point, on the basis of memory, that I had said something ridiculous – sufficiently ridiculous that the adults' laughter was excusable. If I'd had any resentment toward them about this, I would have resolved then to forgive and forget. So in this case, too, episodic memory provided for making decisions about the future by learning from the past – this time, by learning

[1] Mahr and Csibra (2018) are notable dissenters. They argue that episodic memory has a communicative function, enabling us to represent and communicate the reasons for our claims about the past, and thereby to more effectively enforce social commitments. Their view is broadly compatible with the one to be developed here: I don't deny that episodic memory has this function in linguistic communicators. But I propose that it has other non-communicative functions, so its emergence may not be closely tied to that of language, as Mahr and Csibra suggest.

[2] My use of 'epistemically generative' here differs from that of Mahr & Csibra (2018, pp. 4-5). They use it to indicate that remembering generates a reason for believing that a remembered event occurred – *viz.*, that we are remembering it.

something which I not only didn't know at the time of the event, but was not even in a position to know.

These cases illustrate how the epistemic resources made available by episodic memory outstrip those provided by semantic memory. Semantic memory can only store what is learned: it makes available information acquired in the past. Episodic memory, by contrast, facilitates learning from the past. By storing rich, contextual representations of events, it preserves opportunities for learning from those events even after they are concluded.

3. It is one thing to say that episodic memory uniquely facilitates learning from the past; another to say that this is its function. To establish the function of a trait, one must identify a selection-relevant problem facing the ancestors of individuals with the trait, which the trait would solve more efficiently than available alternatives. Thus, the plausibility of any story about episodic memory's function depends on which creatures episodically remember, which problems their ancestors faced, what the available alternatives were, and their costs relative to episodic memory. We do not have clear answers to any of these questions. So, unavoidably, any account of episodic memory's function will be speculative. Nevertheless, we can take the following as plausible starting points. First, humans episodically remember. Second, early humans faced problems exerting selection pressure in favour of individuals who could reason intelligently about the world, develop skills and navigate complex social situations. My proposal in this section is that learning from the past confers benefits in each of these domains. Consequently, selection would likely have favoured individuals who could learn from the past – individuals with episodic memory.

First, it's widely acknowledged that semantic memory is adaptive in part because it represents the regularities by which the world is characterised, thereby enabling us to anticipate events and make appropriate decisions. But of course, our understanding of the world is often only approximate: sometimes our expectations are violated, and it is not always apparent why. Understanding apparent exceptions to regularities can be valuable since it provides for a more accurate picture of the world, in turn promoting more effective strategies. It is significant, then, that episodic memory increases an organism's opportunities for understanding exceptions to regularities.

For instance, consider an early human whose experience has led him to believe that bees are harmless. One day, he is stung by a bee, and it is not apparent to him why this has happened. From the point of view of semantic memory, the options are limited: semantic memory can only store what has been learned, and what has been learned is simply that bees are sometimes harmful after all. But this suggests no strategies for avoiding bee stings besides avoiding bees altogether – which might be costly, since honey is an important source of nutrition (Crittenden, 2011). On the other hand, if he can episodically remember this event later and compare it with relevantly similar subsequent experiences, he might determine what predicts bee stings: perhaps stinging bees have a distinctive appearance or distinctive behaviour. Now he can take steps to avoid being stung in future. More generally, learning from the past confers an advantage in situations where a more sophisticated understanding of the world's regularities enables one to navigate life more successfully. It seems likely that such situations became more common as human evolution progressed.

Similarly, episodic memory can drive the development of skills. Consider an early human learning to control fire. She has a method for generating fire, but encounters a situation in which the method fails, and it is not apparent why. Once again, if she had only semantic memory, her learning from this event would be limited: she has not learned why the method fails, only that it sometimes does. But if she episodically remembers this event, she can subsequently compare it with similar experiences and ascertain the nature of the exception:

perhaps her method fails when the fuel is wet, or when it is windy. Having realised this, she will be able to refine her technique – by keeping fuel dry, or shielding the flames. In short, she is in a position to become more skilled, in a way that is likely to contribute to her survival and that of her relatives (Wrangham, 2009).

It seems likely that episodic memory also plays this role in the development of more complex skills, whose exercise requires on-the-fly minute adjustments of technique in response to a multitude of situational parameters. Elite sport is a familiar example, but sophisticated methods of hunting and tool manufacture among early humans would likely also fall into this category. Whilst the exercise of such complex skills is often taken to occur without thought, episodic recollection and reflection on past performance is likely key to the refinement of these skills (Christensen, Bicknell, McIlwain, & Sutton, 2015; Sutton, 2007). In particular, the retroactive learning episodic memory affords enables one to discern both what situational parameters are relevant to success, and what sorts of adjustment they require. Given the advantages conferred by expertise in skilled domains like hunting, this seems likely to have driven selection in favour of episodic memory.

Finally, episodic memory confers similar adaptive benefits in the social domain, by enabling individuals to retroactively make sense of difficult or confusing social interactions which may have an enduring significance for their relationships. The case described above from my childhood is an example of this. Another is described by Katherine Puddifoot and Lisa Bortolotti (2018): a new colleague fails to make eye contact or greet a co-worker, leading the latter to suspect that he will not be a good or supportive colleague. Later, the co-worker learns that the newcomer received bad news just before this incident, reinterprets her memory and revises her assessment of him. Social interactions are complex and confusing. They can have lasting effects on important relationships even when it is unclear at the time what those effects might be. Remembering and reinterpreting social interactions in the light of subsequent experience enables one to more effectively keep track of alliances and rivalries. It is not difficult to imagine that, as social groups became more complex and key to survival, selection would have increasingly favoured such a capacity in our ancestors (Humphrey, 1976; Moll & Tomasello, 2007).

This is particularly likely on the hypothesis that a key factor driving human evolution was the increasing importance of cooperation, creating pressure to choose effective collaborative partners and to avoid ineffective partners or cheats (Baumard, André, & Sperber, 2013; Tomasello, Melis, Tennie, Wyman, & Herrmann, 2012). As well as providing one with information about which individuals have been reliable in the past, the retroactive learning episodic memory affords may support the detection of cheaters. Suppose one has an interaction with another individual who is behaving strangely – not making eye contact, shifting from foot to foot. If this individual later betrayed one's trust in a collaborative situation, one might episodically revisit this episode and reinterpret it, hypothesising that these odd behaviours were perhaps signs of dishonesty. One might then exercise caution when potential collaborators exhibit these behaviours in future, and thereby avoid the costs of partnership with a free-rider.

I've argued that by storing rich, detailed representations of events, episodic memory makes it possible to learn retroactively from situations we do not understand, or which violate our expectations. That episodic memory is particularly useful in these situations – ones which surprise or confuse us – might explain the bias toward recollecting atypical events over ones which conform to type (Morewedge, Gilbert, & Wilson, 2005). The retroactive learning that episodic memory affords confers substantial benefits in three domains: reasoning about the world, developing skills, and navigating social situations. This seems likely to have created selection pressure in its favour. Thus, there are grounds for thinking that the function of

episodic memory is the storage and retrieval of information about the past: memory is 'for' remembering, after all.

4. The foregoing argument implies that a radical change is needed in episodic memory research in comparative psychology, because of the important role played by evolutionary perspectives in this research programme. First, claims about the function of episodic memory inform judgments about its probable phylogenetic distribution. If one thinks that episodic memory's function is future-oriented mental time travel, and that nonhuman animals are unlikely to have benefited from imagining future events, then it will seem unlikely that nonhuman animals have episodic memory (Suddendorf & Corballis, 2007). Second, evolutionary considerations suggest that some behavioural tests for episodic memory are more appropriate or probative than others. The idea is that a trait should operate most effectively in the situation in which it contributes to fitness (Klein, Robertson, & Delton, 2010). So, on the mental time travel account, we should primarily investigate episodic memory in animals by investigating their capacity to anticipate the future, rather than their memory for the past (Suddendorf & Busby, 2005).

Since evolutionary perspectives play these roles in comparative psychological research, it should be clear that the wrong account of episodic memory's function risks severely distorting the conclusions reached about episodic memory in nonhuman animals. If the argument in this paper is correct, then this risk is currently very real. The dominant account of episodic memory's function rests on a mistake: that there is no benefit to the organism in remembering past events. On the contrary, I have argued, episodic memory distinctively makes it possible to learn from the past, thereby conferring a range of adaptive benefits. So, its function is importantly backward-looking. This means that whether animals have episodic memory does not turn on whether they can mentally travel into the future, or on whether doing so would have done their ancestors any good. Instead, researchers should consider which ancestral populations would have benefited from a capacity for retroactive learning, and whether any animals have a form of memory which allows for this. This in turn requires the design and implementation of an entirely new memory task for nonhumans – one which does not simply investigate whether animals can retrieve information learned in the past, but whether they are capable of learning from the past now.[3]

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